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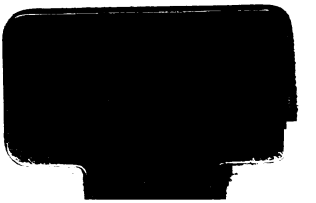

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THE

SCIENCE OF THE WEATHER,

IN A

SERIES OF LETTERS AND ESSAYS,

By Several Authors;

SHOWING THE FALLACIES AND DEFICIENCIES OF METEOROLOGICAL SCIENCE, PAST AND PRESENT, AND THE PRACTICABILITY OF ESTABLISHING A SOUND AND USEFUL PHILOSOPHY OF THE NATURE AND PERIODS OF WEATHER CHANGES.

For the use of Agriculturists, Seamen, Meteorologists, and all interested in, or affected by, the extremes and vicissitudes of the Weather.

EDITED BY "B."

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NAMES AND CHARACTERS OF THE PLANETS.

☉ The Sun.	♃ Jupiter.
♅ Uranus.	♆ Neptune.
♄ Saturn.	♀ Venus.
♂ Mars.	☿ Mercury.

☽ The Moon.

ASPECTS.

☌ Conjunction. | ☍ Opposition.

And every 30°.

INTRODUCTION.

In giving the following letters to the public in their present form, the Editor does so in the hope and belief that he is doing good service to the Science of Meteorology, by placing before them a series of essays of a purely practical character, as well as scientific nature, which have appeared from time to time in various journals, trusting, from the manner in which the various subjects are treated, to induce a more general interest in the science of the weather, than has yet been accorded to it. Above all, he would more particularly direct special attention to those treating of astronomic or planetary Meteorology, as the cause of atmospheric phenomena and perturbations. Of this science it has been said: —"There is nothing of mystery, but everything practical, in Astronomic Meteorology—Meteorology is, in fact, pneumatic chemistry, or the science of atmospheric changes resulting from chemical action — Astronomic Meteorology shows these changes to be coincident with certain positions of the earth to different planets, the action of the rays of which upon matter is demonstrated by the facts of chemistry. If you cross the rays of the sun streaming through the open window, you feel its heat and know its influence to be a fact,—so, if you know at what part of its orbit the earth

will cross the angular ray from a planet, and observe its influence upon the atmosphere, through the barometer, you may also assume that influence as a fact; and, if you observe it of constant occurrence, you then know it to be a fact."

First in the series of essays, &c., presented to the reader, is the work of Miss Barbara Burton, the pioneer of physical astronomy, as unfolding some of the failures inseparable from the old doctrines of astrologers ("astro-meteorology.") The extracts given will be found of great interest, as well as of value in leading to a reform in weather science, as deduced from the relative motion of the earth and planets. The next essay is that by Mr. F. Pratt, F.M.S., "The Positive Philosophy of Meteorological Science." In this, the reader will find the ideas of Miss Burton further matured and practically elucidated in the doctrine of primary influence as deduced from "orbital positions," as contrasted with the angular "aspects," and "mutual" influences of astro-meteorologists. The adaptation of the science to the purposes of observations and their registration is also explained, and practically illustrated by diagrams of the curves of temperature and pressure, and the coincidence of those extremes with orbital positions of the earth and planets. Following this are the letters of Mr. W. H. White, M.B.S., F.C.L. In these will be found an exposition of the different theories of the weather which have appeared during the last few years, philosophically examined by the aid of facts, and their merits fairly canvassed and judged. This is followed by several essays enlarging more fully upon the theory and nature of planetary motion, the structure and composition

of the several orbs of the solar system, and the general influence of the several planets upon the earth and its atmosphere, as illustrated by facts and observations, with a short article on shooting stars. To this series a practical conclusion is appended in the letter of "Mercurius," showing the adaptation of the preceding principles to the prediction of the weather.

Following these, we enter the dominion of terrestrial philosophy, in a discussion and examination of the theories and ideas which found an exponent in the late Admiral Fitzroy, as chief of the Meteorological Department of the Board of Trade,—viz., the theories of solar action, of tidal atmospheric waves, and the development and course of cyclones or revolving storms. These will be found ably reviewed and discussed by "R," in a series of letters, illustrated by diagrams, on "Admiral Fitzroy and his System of Forecast," designed not only to show the fallacies of the cyclonists, but to demonstrate the course or direction of all great storms. To this, his letter on the "Meteorological Department," reviewing and discussing the Report of the Committee appointed to inquire into the whole system as established, and carried out by the late Admiral, forms a particular appropriate conclusion, the "Department" being *non est*, from the want of a theory.

With the letters of Mr. F. Pratt, F.M.S., the series is practically concluded—first, with that on the "Astronomic Law of Storms," explaining the nature and causes of such phenomena, their connection with planetary position, and the influence of the latter upon the operations and "warn-

ings" of the Meteorological Department, this is followed by a series of contributions to the *Shipping Gazette*, forming a review of the "Laws and Phenomena of Weather" in 1866; a Practical Exposition of the Science of Astronomic Meteorology; an Exposure of the Errors and Fallacies of the System of "Means" and "Averages" as applied to Meteorological Science.

In the short article on "Weather in May, and the Extremes of Temperature in April," the design of the Editor is to show the fallacy of the "average" (or "season") theory, practically illustrated by a diagram of the curves of temperature and pressure.

The series concluding with tables of atmospheric phenomena in 1865 and 1866, compiled by the Editor from various authentic sources, to show the coincidence of same with planetary position.

"B."

GLASGOW, 1867.

MISS FRANCES BARBARA BURTON AS A REFORMER OF SOME ASTRO-METEOROLOGICAL FALLACIES, AND THE PIONEER OF THE TRUE ASTRONOMIC PHILOSOPHY.*

"PHYSICAL Astronomy, as a science, contemplates, in the celestial bodies, physical agents in active co-operation for the generation and diffusion of vitality—regards each, as possessing its own inherent nature—each as tracing the orbit as best suiting that nature—and all as in harmonious furtherance of their Creator's design—viz., the maintenence of reproductiveness, through constant interchanges of renovatory properties—planetary influence constituting one of the agencies essential to the stability of our solar system. First, In what consists the nature of planetary action? Second, Wherein consists its modes of action?

"The *nature* of its action is renovatory or benignant.

"1st, Every organised body possesses its exclusive and inherent properties; the nature of which properties depend on the *materials* whereof the body is framed, and on the *form* wherein these materials are organized.

"2nd, It is, therefore, impossible that the properties of any *two* organized bodies, however close their affinities, should exhibit *an identity of nature.*

* The following extracts are taken from a pamphlet, published in 1840.

"3rd, No single or insulated organized body is capable of existence; because no organized body can administer to its own exclusive wants; and because every organization has wants proportioned to its express modification. Consequently, absence of external resources would produce organic inanition, followed by the morbidity of inertion, and by every stage of corruption, until the final decomposition of the whole body.

"Such is the *nature* of that mighty agency denominated planetary influence—its theatre, the universe—its principle, polaric agency—its object. ceaseless resuscitation.

"Its *modes* of action are twofold.

"1st, By aspects of all the planets with the sun, the moon, and among themselves, during their respective courses round the sun.

"2nd, By relative positions in the courses of any two planets, during the respective courses round the sun of the two planets.

"The presence of three bodies is necessary to constitute an aspect—illustrated by the three-fold agency of the galvanic action. In both cases, the presence of three agents is necessary—each of those agents possessing its own innate and distinctive properties; in both cases, each of those agents, separately taken, is *passive;* but, in both cases, when in combination, exhibiting an action the most subtile in operation, and gigantic in effect. It is on a just appreciation of the power of each aspect, that physical astronomy rests for due atmospheric prediction; the more *direct* the aspectal angle, the *greater* being the influence of the aspect.

"Mars is remarkable for the high temperature he diffuses on our atmosphere, on the approach and during the period of his aspects. Before and during an aspect he electrifies the Earth *negatively*, and, at its termination, Mars, over-

charged himself, electrifies the Earth *positively;* and, at the termination of his aspect, *low temperature* prevails—viz., while he is pouring an influx of fresh electricity into the Earth. Spring seasons have latterly been inclement from the relative courses of Saturn and the Earth of late years. Such is the slowness with which Saturn travels, that comparatively short as is the sign of Scorpio, Saturn has been three of our earth's years in progressing along it; and, as the Earth traverses Scorpio every year, during the ten last days of April, and first twenty days of May, our spring seasons of late years have taken place while the Earth's course travelled along the sign then containing the inclement planet Saturn. This annual recurrence of proximity satisfactorily accounts for recent backwardness of spring in these latitudes; and, in further testimony of the above planetary approximating influence, we shall observe, that rather more than thirty years ago, the weather in these latitudes was generally very severe during the spring; and, of course, rather more than thirty years ago, Saturn must have equally been progressing along Scorpio, during three years, and the Earth must consequently been under the influence of Saturn while traversing the sign Scorpio, viz., during the end of April and first two-thirds of May of those years. The transition in temperature in spring of 1839 was owing to the previous orbicular vicinity of Earth to Jupiter. About thirty-two years ago a greater fall of snow occurred on 23rd April than was ever known in a like number of hours in England." Miss Burton closes her pamphlet on Physical Astronomy as follows:—"When good sense has banished pedantry, and astronomy details celestial movement according to *fact*, the noble simplicity of the science will become apparent; and the object of most of the phenomena within our solar system will prove *one and the same* with the actuating principle of the universe, viz., the accumulation

of renovatory reproductiveness. The planets, then ceasing to be considered as mere retrograding or stationary puppets, according to the whim of man, will be registered as *independent orbs*, holding distinct and *uninterrupted courses* in the constant interchanges of mutual renovations. Planetary aspects, now held in derision, will then be recognised as grand laboratory operations—splendid mediums of resuscitation, wherein the planets mutually decompose, extract and attract from, or infuse within each other their specific elementary properties, rendered morbid in the original planet from accumulation—but which, on aspectal transmission, become redolent of invigoration and fructification.

"Nothing advances astronomical perception like cultivating an habitual sense of the share borne *by the Earth* in every operation of the solar economy; since, ever and always, our beauteous planet participates in the diffusion and reception of the elements of atmospheric vitality; ever and always decomposing, extracting and attracting integral portions from every planet which either she passes or passes her; and the inherent properties of every other planet, wherever overtaking her, or being overtaken by her, in like fashion decomposing, &c., from the Earth integral properties suitable for their respective renovations. But, until man has become habituated, nay, *familiarised* to consider himself as sailing on his own beautiful world, amidst the other worlds of his system, and, furthermore, to regard *that system* as constituting a *community* of *administrative* and recipient agents, whereof his own actively revolving world forms a mere integral part of the whole, Man will never justly estimate the planetary influences developed by physical astronomy."

POSITIVE PHILOSOPHY AS A FURTHER REFORM, AND A PRACTICAL EXPOSITION AND SYSTEMISING OF PLANETARY ACTION.

(BY FRED. PRATT, F.M.S.)

WITH DIAGRAMS.

"To know
That which before us lies in daily life,
Is the prime wisdom."

To the critical reader of our present issue, a great difference will doubtless be observable, both in the matter and philosophy of its contents, when compared with those of other publications devoted to this branch of meteorological science. As the inevitable result of changes which have taken place in the views of several prominent advocates and supporters of the science (the promoters of the present Association),* after twelve months' close observation and rigid investigation of its facts, some preliminary explanation is necessary to enable our readers and subscribers to understand the philosophy of the theory which investigation has induced us to adopt, and appreciate its utility in studying the different branches of meteorological science. As regards Astro-meteorology, its theory is based upon the fact, observed in connection with the Ptolemaic Astronomy, that the planets, in their progress *round the Earth*, formed a constant succession of angular

* Copernican Meteorological Society.

positions, or aspects, with each other *and the Sun*, each of which had the effect of producing in our atmosphere certain meteorological phenomena corresponding to the nature of the planet and the "sign" of its location, as found by successive observation to prevail at such aspect. This formed what may be denominated the *Aspectal System*. On rigid investigation, however, this system will be found to embrace many inconsistencies, fallacies, and failures, the necessary results of the defective astronomical knowledge of the early ages. Hence the impossibility of every effort to obtain any reliable clue to a knowledge of weather-changes, or obtain satisfactory and useful data for observation. With this experience, therefore, we purpose to inaugurate another more in accordance with the facts and principles of meteorological science, and in harmony with Astronomy and Philosophy.

To the most ordinary observer of weather, one most remarkable fact must have been frequently apparent—viz., that, so far from coinciding with the numerous and often contradictory "aspects," it has frequently been entirely different from that "predicted" by the rules, enduring, again, through a long interval or "period" of the most remarkable homogeneity, despite the most conflicting aspects. This is of constant occurrence. Of this fact, therefore, we purpose to avail ourselves as a basis for scientific observation, and the foundation of a *Periodic System of Astronomic Meteorology*.

Investigating the philosophy of the Heavens, as taught by Copernicus, we find that the Earth, during its annual period, describes a circular figure round the Sun, termed its "orbit." Interior and exterior to this orbit, other planets also revolve, describing a similar figure, in periods ranging between two months and one hundred and sixty years, according to the relative velocity and distance of each from the Sun. To or from each of those planets a stream of

influence or ray *constantly* proceeds, intersecting the orbits of the Earth and other planets in certain points or angles. When the Earth or planets, then, arrive at these points, they pass *through* this angular ray or influence, the impartive or exhaustive action of which is the cause of those changes in the density and thermal condition of our atmosphere which constitute the phenomena of Meteorology. As respects the orbit of our globe, these planetary rays appear, from observation, to intersect at angles of 30°, at which distance the influence seems to be exerted in its greatest intensity. In the case of the planets beyond the orbit of the Earth, once in each month, *nearly*, the Earth passes through a succession of these angular rays, which, by expanding or contracting the gaseous matter of the atmosphere, give rise to a season or period of heat or cold, of storm or calm, of humidity, rain, or drought, according to the nature and duration of the influence of the planet and its zodiacal position. In the case of Mars and Venus, the rate of motion of those two planets approaches so nearly that of the Earth that their aspects are formed at greater intervals. From this circumstance, the months of their occurrence are found remarkable for certain modifications, not only of the usual "periods" of the remoter planets, but of the Meteorology of the month itself. As regards the planet Mercury, the motion of this orb is so rapid, and its orbit so small, that its only direct influence upon the Earth is in conjunction with the Sun, an aspect which takes place nearly bi-monthly, and is *generally* the origin of remarkable electric phenomena, according to its coincidence with or antagonism to the periodic aspects at the time of its occurrence.

On these "orbital aspects," or influences, the nature of the meteorology we experience will be found to depend.

The above brief outline will suffice to afford a general idea of the primary principles of the Astronomic theory, the

application of which to the purposes of observation we will now proceed to illustrate, by the orbital aspects and meteorological phenomena of the first two months of the present year, as illustrated by our diagram of the fluctuations of the barometer and mean thermometer of these periods. In this diagram, the line of dates at the top being supposed to represent the line of the Earth's orbit, the characters above show the influence of the planet crossing the Earth's path, and through which it passed during the period denoted by the dates beneath. The mark (X) is supposed to represent the "transition period," or point where the Earth passes from the influence of one planet to that of another, often the occasion of remarkable phenomena, in the extention of a period, the development of great vicissitudes, and the production of barometric and thermometric *mixima and minima.** In Jan-

* A very clear idea of the nature and action of planetary influence upon the globe may be obtained from one of the simplest illustrations of natural philosophy. Holding a loosely-filled bladder of air before the fire, the air will become rarefied and expanded by the heat, sufficient to burst the membrane, if allowed to remain. On exposure to a cold blast, it will, of course, immediately contract in bulk. If we now suppose a circular apartment, the walls of which are pierced with a great number of wide openings, each terminating in an apex, forming passages for the ejection or influx of an irregular succession of hot and cold blasts, and cause a large bladder or balloon filled with air or gas to revolve slowly before the openings, it will be made to expand and contract to a degree corresponding to the nature and succession of the currents before which it revolves. Let the balloon and its gas now represent the earth and its atmosphere, the circular wall its orbit, each opening the divergence of a "pencil" of rays proceeding to or issuing from the planet represented by the "apex," and we have in the alternate expansion and contraction of the balloon an exact and simple illustration of the meteorological phenomena of the globe. Transferring this idea, again, to our diagrams, we have the orbit of the earth in the date line, the extent of each orifice or "influence" shown by the boundary (x), the apex or "intensity" by the line proceeding from the symbol above, which,

uary we have four "orbital" aspects—Herschel, Saturn, Jupiter, and Neptune; the last two intensified by combination within twenty-four hours. To these is added the bi-monthly aspect of Mercury in conjunction with the Sun, (the cause of extreme vicissitudes,) occurring here with the aspect of Saturn. With this the meteorology of the month was in strict accordance. The barometer reached its highest point in December, with the "transition" to Herschel, on the 27th, marking 30·52, the maximum of the month—a mean temperature of 28·5° on 29th. January 2, from 30·42, the barometer fell rapidly to 29·83 with the aspectal culmination, rising to 30·20 as the Earth passed out of this influence. As a "storm period," the usual succession of gales prevailed on our coasts, though in a mild degree. On the northern coast of America, however, the gales were extremely heavy, and inflicted great damage. With the "transition" of 7-8, we had again extraordinary vicissitudes, barometer falling 0·42, with a rise of minimum temperature of 26·5° in sixty hours —gales in Ireland, at Dover, and Milford. 7th, at Patras, "still daily shocks" of the earthquake of Dec. 26th; and another earthquake in Saxony on the 9th. Passing into the next period, after two days' interval, the barometer renewed its depression, reaching 29·44 on the 11th, simultaneously with a terrible gale all over the kingdom, which died out on the 12th, when the aspects were complete. This was a most extreme storm period, extending its ravages all across the Atlantic. In the next period, we have a most remarkable illustration of intensity of action, from the influence of coinciding planets in aspectal combination. After a mean on the 8th of 51·5°, the thermometer commenced falling,

crossing the orbital line, shows by the curves beneath the changes produced in the pressure, density, and temperature of the air by the influence intersecting that portion of the earth's orbit. What can there be "mysterious" in this?

from the exhaustive influence of Mercury. The influence of the following period coinciding, the depression continued uninterruptedly to the 18th, the aspect of Neptune—a mean of 26·5°. In nine days, the mean ranged 26°, the extreme range 32°!* This day was the lowest of the month. 21st, the mean rose to 32; on the 24th, it marked 48·5, as the Earth passed out of the influence. As a consequence of this extreme fluctuation, the gale period which ensued was terrific, commencing on the 16th with the Admiral's "warning," and gales at Banff, Whitehaven, Dublin, Dundalk, &c., to the 24th was one continued succession of storms and hurricanes all round the kingdom. After a maximum of 30·13 on the 18th, the barometer reached its lowest, 29·52, on the 22nd, when the storms of our latitude began to wane. After a slight rise, on the 23rd, the cyclone from the south reached our shores, again depressing the barometer, and spending its fury in "hard gales," producing the most disastrous wrecks, whilst every port was crowded with shipping seeking refuge from the hurricane! Reports subsequently arrived of im-

* Two remarkable extremes characterise this period. In the northern hemisphere, we were experiencing the *greatest cold* of the winter; in the southern, they had the *greatest heat* of the summer, thus described by the Australian correspondent of the *Times*:—"After a remarkably cool, and even cold, summer, which was wet in the early part, we had on the 14th and 15th January two days of excessive heat, of which description can give no just conception, and the details of which always create doubt in the minds of Europeans. These extraordinary days only occur once in three or four years. The 14th was excessively hot, without wind. On the 15th, the temperature was higher, and it blew very hard. The heat of the wind was like that from a furnace, or that which has passed over a surface of heated iron. Various thermometers in the shade marked 105, 106, 108, and 111 degrees!" This fact is of interest, and worthy of record, as showing the practical benefit which would accrue to the science, from systematic and simultaneous observations of these periods in the different quarters of the world.

mense losses of life and property in the Black Sea, during that period. At Washington, 23rd, "weather dreadful all over the country—storms, rain, snow, sleet, frost, and thaw, all intermingled!" 24th—San Francisco inundated—the streets navigable in boats. 26–7, at Quebec, the heaviest snowstorm of the season. In St. Lucia, West Indies (25), "*last eight days* very boisterous—continual heavy rain, with high winds." 24th, at Grenada, "continued excessively wet, with much damage from storms of wind—roads impassable, and hazardous to life." The month closed with the "transition" to Herschel, the mean temperature falling 11° in 24 hours. Remaining nearly stationary for two days, it then rose as rapidly, and reached the maximum of the month, 54°, on the 31st—a range of 15° in four days. In the same time, the barometer fell 0·6, the Herschel aspect again making a depression, differing only 0·1 from that of the 3rd, accompanied by the usual gales in many parts of the kingdom, and violent hurricanes in the Mediterranean, &c. Owing to the vicissitudes of the last few days, much damage occurred from heavy rains and floods, by which many parts of Ireland suffered most severely.

That which is most remarkable, however, is the difference of the mean temperature of the two Herschel periods, producing a contrast apparently fatal to the accuracy of the science. Here, however, we have an illustration of the nature and results of mutual influence, resulting from zodiacal position. In the interval between the two aspects, the relative motion had brought Mars in conjunction with the Sun to Herschel, on the 25th, elevating the temperature of that planet, it may be supposed, similar to our experience from a similar conjunction to us in last August. When in aspect to Herschel, its influence to us therefore became "impartive," so that there ensued a difference of 18° in the mean of the two periods, with other phenomena equally remarkable.

In February, as seen by the diagram, we have seven orbital aspects—with Venus displacing that of Mercury; Mars, that of Jupiter with Neptune; and a double solar combination of Mercury and Venus occupying the void at the end. In consequence, we have the whole month in remarkable contrast with January—the season periods transferred, an almost general absence of storm phenomena and rainfall, and a month overcast and gloomy in the extreme. Commencing with the Herschel period, we have the high temperature of the close of January till the aspect of Venus, on the 4th, coincident with which we have a great depression, the mean falling 22° in four days. 8th, the earth passing into the influence of Saturn, we have a rise of 11° in three days. Entering the influence of Jupiter, the mean again fell, though but slightly compared with the same period of January, arising from the interposing aspect of Mars between those of Jupiter and Neptune, from which the mean rose another 11° in four days, marking the greatest temperature of the month, in contrast to the same period of January, when the mean stood 24° below the present. Owing to the proximity of the orbit of Mars to that of the Earth, the immensely remote influence of Neptune was almost completely overcome, and we experienced a very warm, humid, and overcast period to the 22nd. The "transition" of this and the following day gave rise to remarkable and dense fogs, prevailing very generally over England and many parts of the North Sea. On the 23rd, in London, the dense fog and gloom which prevailed fully equalled any November experience. This phenomenon arose from the passage of the Earth from the warm rays of Mars to the cold and humidity of Mercury and Venus, by which the moisture previously held in solution by the warmth of Mars became suddenly precipitated, and rendered visible in dense, foggy, vapour. Passing into the influence of the two planets in solar conjunction, the temperature fell rapidly, marking a

range of 16° in four days, on the culmination of the aspect. The period was very remarkable. For five days the heavens were obscured by an impenetrable mass of dense and gloomy vapour, with a "paralyzing" east wind, depressing the vital powers to an extreme degree. The month closed with a lighter sky, and rising mean, to the 1st, when the transition to Herschel (now restored to its normal influence again) plunged us into the frosts of winter, the temperature reaching its lowest on the day of aspect.

The entire Meteorology of the month was most remarkable, and furnished some curious illustrations of the nature and action of *orbital* and mutual influences, both in "rules" and exceptions. It was marked by the rare occurrence of two aspects of Venus, the solar conjunction of which is usually the cause of a period of much continuous rainfall. The occurrence, in the same month, of the orbital aspect of Mars, with its heat and drought, formed the exceptive rule, and sufficed to overcome the pluvial powers of Venus, substituting, as a *mean* of the two influences, a *neutral* Meteorology—a sky densely overcast with formless, gloomy vapour, and an atmosphere loaded with moisture, at times to "saturation." Directly and indirectly, the Earth was influenced by Mars the entire month, in every period—hence the extraordinary drought, in the face of the rainiest aspects of the year. To the "orbitals" of Venus and Neptune it opposed its own; to that of Herschel its solar conjunction; to those of Saturn and Jupiter, its "mutual" square; and to the powerful solar positions of Venus and Mercury its mutual sextile—a continuity of effect seldom observable.* To the agricul-

* We have demonstration of this afforded by the experience of March, a month also peculiar for one of those irregular positions of our globe to Venus, which culminated on the 20th, in combination with one of Neptune on the 21st—positions similar to those of Jupiter and Neptune in the diagram for January. The period commenced

turist, the Meteorology was most favourable. To the mariner, also, the change in the aspects was equally beneficial, *all* the periods contrasting strongly with the storms and hurricanes of January, arising from the solar conjunction of Mercury, its double aspect with Saturn, and the double aspects of Jupiter and Neptune. The absence of such extreme phenomena is, however, more particularly owing to the mutually-balancing action of Mars and Venus, modifying the intensities of the storm periods, as will be seen by referring to the diagrams, in which the mark (X) shows the days for which gales were "warned" by Admiral Fitzroy, and their coincidence with the aspects; the figures beneath showing the number of ports in the Kingdom from which returns of actual "gales" were received and published in the *Shipping Gazette*. These references, and the fluctuations of the barometer and thermometer, with the coincidence of the

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with rain, changing to snow, in Somersetshire, by the 16th, increasing to the 21st, when the fall of snow in that and the adjoining county of Wilts "was the heaviest known for some years." In England, it was "the roughest and wettest week of the winter;" with uninterrupted rain over the entire North of France. The rain continued the whole period, marking, to the 27th, a monthly fall of 3·11 inches, against 0·42 inches in February—a difference of 2·70 inches, to testify the power of Mars over that of Venus, and illustrate the influence of the latter as the cause of excessive rainfall and floods. Let us suppose, for example, the tri-monthly aspects of Mars to have occurred in January and April, in place of February and May, we can then realize from our present experience what would have been the effect of the Venus aspects of the past two months upon agricultural operations, and upon the food-supplies of 1862; such are the important effects of *astronomical* position upon the world's progress. Under the Ptolemaic system, these aspects have been suffered to pass wholly unrecognized, *leaving the meteorologist without any clue whatever to nearly fourteen days of excessive and universal rain and snow*,—a fact which amply demonstrates the necessity for the progress in Philosophy which we seek to inaugurate.

aspects and transitions, show at once the connection between Astronomy and Meteorology, and the immense value of the astronomic philosophy to all classes—the merchant, the mariner, the agriculturist, and the philosopher,—in every land, latitude, and climate.

By the aid of the theory we have explained, and the practical illustrations afforded by the diagrams of the fluctuations of the instrumental curves observed in connection with the passage of the Earth through these "orbital aspects" or rays, both in combination with the Sun and each other, and the general meteorological phenomena coincident with those "periods," we think any one of the most ordinary capacity may be enabled to enter upon a course of observation of the most practical and useful character. We would also most particularly urge upon every one to transfer their observations to a diagram similar to those given. Let the lines and curves of mean temperature be traced with a little vermillion, and the spaces between the daily extremes with some light tint, so as to show the displacement of the mean and daily temperature, &c. This will be found one of the most valuable aids to study and investigation that can be had. Drawn up in this way, such diagrams appeal at once to the reason through the eye, and afford evidence the most incontestable of the reality of the Astronomic philosophy. On the other hand, their practical utility will be found equally great. To the mariner and the fisherman they unfold and explain the causes of barometric fluctuations, *in every part of the globe*, so that the duration and intensity of a "storm period" may almost be calculated and understood by inspection, and timely precaution taken against the probable consequences. To the agriculturist, they point out the "times and the seasons" most favourable for the operations of the farm, the gathering of his crops, and the period to which his labours may be extended with the most probable safety. To the

meteorologist, they serve as a guide, pointing at once to the hitherto hidden causes of the tidal phenomena of the atmosphere, the elevation and depression of its temperature, and the minor daily phenomena resulting from lunar influence. To the philosopher, the physiologist—to all, in fact, who delight in unfolding and investigating the wondrous phenomena of nature,—they will lend such facilities as will not only lighten their labours, but render those labours of the highest value to science and the welfare of the human race,—the great aim and end of positive philosophy.

CHANGES OF THE WEATHER AND THEIR APPROXIMATE CAUSES.

(By W. H. White.)

No. I.

The Changes of the Weather at all seasons of the year have occupied the master minds of all ages for at least two thousand years, and, strange to say, the true science of the weather has never been fully arrived at. This fact alone must demonstrate very clearly that "*causa latet*" is as true now as it was two hundred years before the Christian era; for even at that remote period mariners, shepherds, intelligent and observing husbandmen, and many others whose employments were in the open air, could foretell the coming changes with quite as much certainty as the meteorologist of the present day.

Meteorology—for such is the term given to all the changes to which the atmosphere is subject from all causes whatever—is of very little utility unless it can be made predictive. This is the use to which every almanac-maker wishes his almanac to apply, but, alas! how many of these weather-wise prophets have fallen short of the high pinnacle of meteorological fame they aimed at.

It may not therefore be altogether uninteresting, even to the general reader, to glance at the theories at present extant.

First and foremost on the list stands ADMIRAL FITZROY, who is backed up by Government support and high patronage throughout the length and breadth of the land; but his predictions are limited exclusively to storm periods, and these from observation alone, and hence his predictions are at very short date, sometimes a few hours only, and at most twenty-four to thirty hours. Yet even these short notices enable him to send telegrams to most of the English ports to warn the sailors that a stormy period is at hand, by which means he has been enabled to save the lives of many brave seamen, and to prevent the loss of much valuable property. But this method, useful as it may be, does not furnish even the most remote hint at the cause of the predicted storms which are thus signalised, and hence man's knowledge of the cause of storms at any period of the year is by no means increased; so that, whenever it shall please the God of storms to remove the Admiral from among men, the theory of the causes of storms which have been forecast will die with him, and, therefore, man will still be as ignorant as before the Admiral commenced his career.

This is a grievous state of things, but it is nevertheless true. Many of the storms which were predicted by the Admiral did not come at all, while others came unpredicted; facts which clearly prove that no *theory* can be attached to such a course of prediction, notwithstanding that his system has produced many important results—results that arose from an unknown, and, consequently, an unforeseen cause.

Others predict the weather simply upon comparing season with season, either year by year, or by a cycle of years; but none of these cycle of systems have hitherto produced any satisfactory results.

The most important cycle system on record was carried out, during nearly a whole life-time, by Mr. George

Mackenzie, of Perth. The merits of his system rested in an excess or deficiency of east winds—these seemed to alternate about every three years. After a cycle of 17 years, he was encouraged to try another 17 years, and was again induced to try a third 17 years, making about 28 observations per day; but at the end of this period, which I believe was carried to 54 years, its persevering author was summoned away from earth; his theory sank with him:—a like fate to that which awaits every system of weather prediction not founded on a scientific basis.

If any system of a scientific character, which has been carried on by one person for many years, and the author of that system dies, the system must die with him; but any theory, whether true or false, when its author dies, may be continued by his successors, provided the rules and principles of his theory be left behind him, and which, if proved to be false, will soon be fully exploded, and, if true, will be carried on to perfection.

Now, with respect to meteorology as to astronomy, chemistry, or any other science, it is quite certain there can be but *one true theory;* and, therefore, as the knowledge of cause and effect increases, so will the true theory of atmospheric phenomena ultimately be arrived at.

No. II.

PARALLEL SEASONS.

If peculiar and unseasonable weather happen at one particular period of the year, some persons predict that weather exactly the reverse will immediately follow. Such, for example, as the mild and humid autumns of 1837, 1844,

1854, and 1860, which were followed by cold of greater intensity than at ordinary seasons.

Thus, the extremely mild autumn of Christmas of 1837 was followed by long and severe frost, commencing on the 1st January, 1838—a period memorable for the late Patrick Murphy's famous prediction of the coldest day on the 20th, on which morning the thermometer at the West India Docks stood at 7 deg. below zero. Mine was 3 deg. below zero. In 1844, the early portion of the winter was very mild, viz., January and February, so that it was generally believed that the season would pass away without any real wintry weather; but on the last night of February real winter commenced, and continued through the whole of March, rendering that month the coldest March on record. On the 14th of that month, the minimum thermometer registered in Suffolk 5 deg. below zero, and in several other localities they had thirty degrees of frost.

In 1853, there were two minimum points of winter temperature (Feb. 19th), when the thermometer recorded 25½ degrees of frost, and (Dec. 29th) twenty degrees of frost.

In 1854, the autumn and early winter were very mild, but severe frost commenced on the 16th of January, 1855, so that February in that year was the coldest ever known in England. On the 18th, the thermometer registered 30½ degrees below freezing, and the frost continued with considerable severity for six weeks.

In 1860, after a mild and wet autumn, the weather became intensely cold about the 17th of December. On Christmas-day my thermometer was seven degrees below zero, or thirty-nine degrees of frost, while in some localities I was informed the thermometers registered ten degrees below zero; but on the 29th of December my thermometer recorded two degrees above zero, so that the great intensity was but of short duration.

The autumn and early winter of 1863 very much resembled those of the year above alluded to—viz., warm, wet, and boisterous—which induced Mr. Thos. L. Plant, M.B.M.S., of Birmingham, an eminent meteorologist, on the 24th of November, to predict that a similar degree of severity would follow, either at the close of the present year, or early in the next, and then he added very candidly, "whether its advent will be in December or deferred till after Christmas cannot now be stated,* but the longer the inclement season is delayed, the greater will be, I apprehend, its severity."

Mr. Plant published in the *Times* of December 29, another notice, to say that the expected severity would be put off till the New Year. I do not anticipate that extreme severity of which Mr. Plant gives warnings, but I do foresee after the frost of the New Year a long period of wintry weather, protracting itself to one-third of the month of April, or nearly so.

It appears to me, and I think it must do so to every rational mind, that no weather theory can be drawn from such slender materials as these; for it must be apparent to every careful observer of the phenomena of the atmosphere, that whenever there is an excess, whether of rain or drought, heat or cold, there must be a reaction, so that seasons soon recover their wonted equilibrium.

For example, in June, 1863, we had an excess of wet up to the 19th, on which day there fell 1·1 inch of rain, with a fall of ten degrees of temperature, but then a reaction took place, and we had no more rain till the 21st of July, with the thermometer marking 65 deg. on the 19th of June, while

* My prediction in the St. Leanord's *Gazette*, published at the end of November, was, "an open Christmas; the year will probably end with mild, damp weather," so that the mild December was fully stated.

on many days in July it marked 82 and 83 degrees. If we therefore note these extremes as they occur we soon learn that Dame Nature makes up the deficiencies of one month, by the excesses of another.

Still, we now and then find an exception to this rule. For December, 1795, the weather was described by the late Mr. John Adams, of Edmonston, as mild, the lowest degree of temperature being 30 degs. at 8 P.M. On the 26th, he says, "south-westerly and westerly winds were most prevalent this month, with frequent small rains, and *nothing like winter prevailed.*" We ought, therefore, to have looked for extreme cold to follow, if the rule be without exception, but January, 1796, was so mild, (the lowest temperature being 30 degs. on the 9th night) that the periodical publications teemed with proofs of the great mildness of the season." I cannot see, therefore, that parallel seasons add anything theoretically to meteorological science.

Yet, what avail all these reasonings when the causes of these "givings and takings" are not once hinted at; and at the same time the observers of these irregularities themselves tell us, that "every effect is the result of some adequate cause;" but they rarely take the trouble to seek out that cause!

Therefore, the laws of meteorology will lie dormant till doomsday, unless some efficient cause be assigned, in order to help observers to trace out the *true* cause.

Every effect in creation was the effect of an efficient cause, which cause man has laboured many years to find out. But, as regards the changes of what we denominate "weather," he has yet made very little progress.

Astronomy has assigned causes for every motion and vicissitude respecting the heavenly bodies, and those causes have been verified again and again, and hence astronomy now is a well known science, although man is not yet perfect

in it. But astronomy went through its theories, till a master mind was raised to fix it on a firm basis. Similar reasonings might be applied to chemistry, geology, botany, &c. Meteorology, too, will some day find its level among the sister sciences.

On mentioning the laws of meteorology to a member of the British Meteorological Society, he said that he believed that "by constant registration of his instruments, he would ultimately arrive at the laws of electric and magnetic intensity, and the causes of all meteorological phenomena." My reply was, "If you register till doomsday you will not produce the cause of a single effect." Nearly twenty years have elapsed since the above conversation took place. The Greenwich observations have been steadily carried on ever since, the British Meteorological Society has been established in connection with the Royal Observatory over ten years, their observations have been published quarterly, pamphlets and papers have been issued at intervals, but not a single cause has yet been arrived at; indeed, the very system they adopt, that of *averages*, will not conduce to the establishment of any law, but will lead them farther away from it.

It is the extremes of all phenomena that will point to their causes, means will only lead farther away from them.

Since all attempts at prediction are forbidden, not only at Greenwich, but at all other observatories, the science of the weather will never come from those aristocratic sources. A gentleman, a M.B.M.S., was severely reprimanded at one of their late meetings for even hinting at such a thing as foreign agency, hence—

"Pennas incidere alicui."

If they thus "clip the wings" of their members, we may judge of their final results.

No. III.

THE EQUINOCTIAL THEORY.

"*Parturiunt Montes, nascetur ridiculus Mus.*" This motto appears to me, and, as I think, to every rational mind, to be very applicable to the above weather theory. Dr. Kirwan, nearly a century ago, being anxious to establish some sort of rule for arriving at the weather likely to occur at the season of the year of the highest importance to agriculturists, from observations carried on incessantly for a series of years, established the following maxims:—

1st, "When there has been no storm before or after the *vernal equinox*, the ensuing summer is usually dry, at least five times out of six. 2nd, When a storm occurs from our easterly points, either on the 19th, 20th, or 21st of May, the succeeding summer is dry four times out of five. 3rdly, When a storm arises on the 25th, 26th, or 27th of March, and not before in any point, the succeeding summer is generally dry four times in five. 4thly, If there be a storm at s.w. or w.s.w., on the 19th, 20th, 21st, and 23rd of March, the succeeding summer is generally wet five times in six."

The above maxims were excellent, no doubt, when so little was known about the laws that regulate the seasons. His observations were made in Ireland, and, consequently, on the climate of Ireland—a climate much more wet than that of England, excepting just its western borders; and it is a well-known fact that in consequence of the mild and moist climate, Ireland takes the name of the Green Island.

How, therefore, any person at all conversant with the improvements made in Meteorology since these maxims were penned, can take them up as applicable to England, I cannot

conceive; yet, Mr. Thomas Du Boulay, of Sandgate, has, during the last three years, predicted the weather of the following summer by them, and with some degree of plausibility during some portions, but with failures in others. Yet, this gentleman seems to be working quietly an undercurrent, for he published on the 28th of March, 1861, his further views on his theory thus: "The superior *heat* and *light* which distinguish *every* summer from *every* winter, I attribute to the *agency* of the sun alone. The *monthly, daily,* almost *hourly atmospheric* changes in temperature, moisture, barometric pressure, rainfall, and force and direction of wind, which together constitute the weather of an *average English summer*, and are perhaps necessary to the full force and development of vegetable life, I attribute to the *varying positions* and *agency* of the *sun, moon, and planets* of our system. This opinion I believe *few* would differ from, though *many* would not be agreed as to the proportion of influence due to each."

Now, after M. Du Boulay has so distinctly stated that he attributes an English summer to the *varying positions and agency of the sun, moon, and planets,* he asserts in direct contradiction to this in his pamphlet. (The summer of 1863, p. 3). "To support it (the *equinoctial theory*) in its entirety, it seems necessary to take for granted that *no heavenly body*, except the *sun, has any appreciable influence, either on our equinoctial, or on our summer weather.* The *only exception* to this rule allowed by the writer has been with regard to the *larger comets.* If they should appear, either at the *equinox* or during the *summer, all allowance must be made.*" But what allowance, either in kind or amount, Mr. Du Boulay saith not. Now, if the planets have any influence over the weather at one period of the year, they must have an influence at every other season of year, wholly regardless of the equinoctial week, or of the summer.

The author of this equinoctial theory lays a very particular stress upon the comets disturbing his predictions, for he says, "In the stormy summer of 1860, an important interval of a fortnight's fine weather occurred, during the first half of July, and a comet was in its perihelion about the beginning of that month." In the following year, finding his prediction again at fault, he says, "In 1861, about the latter part of May and the beginning of June, that year was very unnaturally dry." Again, he says, "In 1862, about the end of August, yet another comet arrived at the nearest point to the sun; and exactly a fortnight after that point was passed, a rainy period set in (contrary to his prediction) sufficiently to cause the price of wheat, which had been retrograding, to rise two shillings per quarter in the Mark Lane."

The author of this wonderful theory of weather predictions (for the summer only, be it understood) enlists Madame Luna and the planets, as was shown above, as the active agents in producing changes of the weather, now most uncourteously dismisses the Queen of Night as having nothing to do during the summer months. Hear him speak for himself—"There is a general, though indefinite, idea prevailing that the moon, which rides so majestically in the heavens, the acknowledged Queen of Night, must, from her known action on the tides of the ocean, have some corresponding influence on the atmosphere, but the author, after perusing the works of many writers on this subject, has not, either from them or from his own experience, been able to arrive at any clear and definite conclusions on the subject. *He therefore does not admit her influence over our summer weather here.* Did she really possess such it would greatly complicate any forecasts that could reasonably be drawn from the weather prevailing during the vernal equinoctial week."

So, the poor moon is not to use her influence *in the summer*, because her influence would mar his predictions; but she may

exert her maximum influence in winter, because he makes no predictions for that season.

Now, this is the sum and substance of the equinoctial theory, founded upon observations made about a century ago, when Meteorology was enveloped in the grossest darkness. Dr. Kirwan found that when the sun crossed the *line* about the 20th of March, a change of season became apparent, and the summers varied from each other then, as they do now; he therefore strove to find out the cause—and great merit is due to him for such a discovery in the very infancy of Meteorology—he acknowledged that only *four-fifths* of his ideas are to be all depended upon; and yet Mr. Du Boulay, in face of all the improvements that have been made in the study of Meteorology, attempts to palm so imperfect a system on the enlightened public of 1864. The failures in his prediction in 1861 and 1863 bear ample testimony to the fallaciousness of his equinoctial dogmas. Yet, on the 1st of April—a day sacred to sportive fancy—he professes to come out with his theory for the beautiful summer of 1864, which I anticipate will be in every way beneficial to agricultural interests.

No. IV.

THE LUNAR THEORY.

At the present moment, when so great an interest in the weather is manifested, not only in our daily and weekly papers, but also in our monthly serials, I think a sketch of our prevalent systems not only desirable as general information, but absolutely necessary, that the agriculturist, the mariner, the traveller, the pleasure-seeker, and the invalid may each avail himself of that particular system which is

best adapted to his necessities, or which best fulfils its pretentions to accuracy and scientific truth. Articles on weather have appeared in the *Cornhill Magazine*, *Good Words*, *The Geologist*, *Nautical Magazine*, &c.; but among the most modern writers on the weather, attributing *all* influence to the moon, and rejecting the influence of every other orb composing our solar system, even to the exclusion of the sun—the great bestower of light, heat, electricity, and probably other emanations of which man is at present ignorant—is Lieutenant Saxby, principal instructor of naval engineers of Her Majesty's Steam Reserve.

This gentleman says his Lunar Weather System is extremely simple, so simple, in fact, that he fears many enemies to it will be made on account of such simplicity. But, as simplicity in the English language, is reckoned the greatest beauty of composition, so, I always understood, simplicity in science to be the greatest inducement to its study. Now, as the study of astronomy has occupied the closest attention of the master minds of every age and nation, is it not very remarkable that the moon's influence should have escaped discovery, even as against the keen eye and penetrating mind of a Herschel, an Arago, an Airy, a Mitchell, a La Place, and many others? These all pass by the moon as the mere satellite of our earth, and whose influence is limited to the tides of the ocean. Mr. Saxby explains his "extremely simple" weather system thus:—

"I have found that the moon never crosses the earth's equator or reaches her stitial colure without a marked disturbance of the atmosphere occurring at the same period. Therefore, I began by combining these lunar changes and actual weather disturbances into the relationship of 'cause and effect.' In considering the cause, there was little difficulty in tracing it to disturbance of the electrical system of our globe at such periods, in consequence of changes in the

effect produced on our atmosphere by variations in the intensity of the attractions of the sun or moon, or both, as they vary their positions with respect to the earth. I had before me as a guide the well known and recognised influence of the moon's attraction upon the tides. I find that the *phases* of the moon, popularly so called, do not, perceptibly, affect the weather; that the period of new moon has a marked influence on the weather when occurring near the periods of lunar equinox or lunar stitial colure, and that this influence is heightened considerably, if, at the same time, the moon be in perigee; that the mere fact of her being in perigee is of no importance at any other times. So, that when the lunar equinox or colure occurs at the same period as the new moon in perigee, the greatest atmospheric disturbances to which our earth is liable may then be expected with certainty of fulfilment. Now, either the moon crosses our equator or is at her stitial colure (greatest distance from our equator) about once a-week, and it is invariably traceable. The method in which the weather is affected by the forces of the sun and moon's attraction is in the necessarily resulting sudden condensations of moisture in the atmosphere, or in the increased evaporation of moisture, according as the air is in a state of *positive* or *negative* electricity, in a district, when disturbed by the sudden affection of the whole electric system at the periods above noted. Now, sudden condensation of moisture in the atmosphere produces a partial vacuum, into which the surrounding air necessarily rushes; hence the periods of lunar equinox or colures are periods of 'atmospheric disturbance,' the intensity of such depending much on localities; and were such condensations or evaporations occur upon a large scale, their effects may last for some days, or until the equilibrium is restored. *High winds at these periods are not always accompanied by falls of mercury in the barometer, since no accumulation of the electric fluid (which*

is imponderable) *can increase the weight of the atmosphere.* The above disturbances, operating as they do at the period of lunar equinox or stitial colure, being the immediate result of electric action. I call *primary* or *electric*, to distinguish them from another kind of atmospheric disturbance, which I call *secondary* or *mechanical*, and for the following reasons, viz.—Whether, from the nearer proximity of the equinoctial regions of the earth to the moon, or from the peculiar action of what is termed 'thermo-electricity,' certain it is that such are the places which are subject to the greatest amount of precipitations or condensations. We may, therefore, easily conceive that atmospheric disturbances are there generated on the grandest scale. Hence arises a means of distinguishing my theory into two distinct heads, thus:—The primary effects of disturbance are immediate and stationary; the secondary are progressive, and they travel to a considerable distance. The latter are known by hurricanes and cyclones, and they require some further illustration. The cyclones which affect us derive their origin in the region of about 10 or 12 degrees north latitude, not very far eastward of the Island of Trinidad, then they travel along, very nearly upon the line of equal magnetic variation, until they meet the continent of America, with more or less proximity; and then, whether it be caused by the higher temperature of the Gulf Stream, which shunts them, as it were, across several contiguous lines of magnetic variation and places them upon others in the direction of which (or very nearly) they reach the British Islands. Thus, cyclones always approach us from the southward and westward and proceed towards the south-eastward."

When Lieut. Saxby points out the days in each month in which disturbances are to happen, he gives this cautious *proviso*: "*If the day marked prove calm and still, distrust the day after, and especially the second day after.*" Sir Francis

Moore, physician, adopted this same caution a century ago. But, on perusal, this seems to be an excellent and *dependable theory*, and is unquestionably true on many occasions, as we shall see on giving a test during the year 1863. Yet, although changes take place at the times pointed out, the lunar theory does not explain whether such changes are to consist of heat or cold, wet or dry, frost or rain; nor whether there will be a severe winter, an abundant or scarce summer, a favourable or unfavourable seedtime, good or bad haymaking weather, or bad or good harvest weather—conditions above all which the agriculturists want to know. I therefore consider the lunar theory *not strictly a practical one*. Let us now test its principles by facts drawn from observations made in 1863; and if they are borne out, then the theory is entitled to some respect, and capable of application; but if it will not bear this test, and fails in a majority of cases, then it is not the true theory of the weather—a theory calculated to assist the agriculturists, or to save the lives of seamen from "storms and wrecks."

Before proceeding to the lunar test, I will just mention a new use which Sir John Herschel makes of it in his excellent paper on "The Weather and Weather Prophets," in *Good Words*, for January, 1864. The only influence Sir John attaches to the moon is to convert it into a *Meteorological besom*, for he says, "The only effect distinctly connected with its position with regard to the sun, which can be reckoned upon with any degree of certainty, is its tendency to clear the sky of cloud, and to produce not only a serene, but a *calm* night, when so near the full as to appear round to the eye—a tendency (he continues) of which we have assured ourselves by long-continued and registered observations." Sir John Herschel also expresses a desire that those persons wishing to give this *dictum* a fair trial, will record the state of the sky as to cloud on three successive

nights of lunation—that on which the full moon occurs, and those immediately preceding and succeeding it, from an hour before the rise of the moon, and thence hourly to as late a period of the night as their usual habits will allow.

This new cloud-sweeper, I think, deserves every attention, and, if true, then a patent. Lieut. Saxby says, "I have found that the moon never crosses the earth's equator or reaches her stitial colure without a marked disturbance of the atmosphere;" and again, "I find that the phases of the moon, popularly so called, do not perceptibly affect the weather." Now, as bearing upon the marked distinction of these two assertions, as also upon the statement of Sir John Herschel, in reference to the moon's influence in clearing the atmosphere, &c., I have very carefully compiled a set of tables, taken from my journal for that purpose—the fluctuations of the barometer and thermometer, the amount of rain-fall and the number of wet days, the wind's direction under each, the number of gales and storms, and the difference under each head; also, the state of weather of 1863 during the three days at and near the full moon.

TABLE I.—*Showing the Risings and Fallings of the Barometer and Thermometer, with the Rain-Fall and number of Wet Days during the Moon's Positions during the year*, 1863.

Moon's Positions.	Barometer.		Thermometer.		Rain.	Wet Days.
	Rise.	Fall.	Rise.	Fall.		
On	*Inches.*	*Inches.*	*Deg.*	*Deg.*	*Inches.*	
Equator, ...	2·430	1·029	28·97	30·00	1·87	16
North S. C., ...	1·741	1·445	9·00	4·20	1·87	7
South S. C., ...	0·610	0·840	37·20	38·40	0·83	7
Totals, ...	4·781	3·314	75·17	72·60	4·57	30
Do. of Phases, ...	4·659	3·369	85·50	69·00	3·35	32
Difference, ...	0·122	0·055	10·33	3·60	1·22	2

TABLE II.—*Showing the Risings and Fallings of the Barometer and Thermometer, with the Rain-Fall and Number of Wet Days at the Moon's Phases, during the year* 1863.

Moon's Phases.	Barometer.		Thermometer.		Rain.	Wet Days.
	Rise. *Inches.*	Fall. *Inches.*	Rise. *Deg.*	Fall. *Deg.*	*Inches.*	
New Moon, ...	0·705	0·904	29· 7	13·00	0·88	9
First Quarter, ...	0·896	0·950	14· 3	15·00	0·35	5
Full Moon, ...	0·605	1·360	18· 5	13·80	0·86	7
Last Quarter, ...	2·453	0·155	23· 0	27·20	1·26	11
Totals, ...	4·659	3·369	85·50	69·00	3·35	32
Do. Positions, ...	4·781	3·314	75·17	72·60	4·57	28
Difference, ...	0·122	0·055	10·33	3·60	1·22	2

TABLE III.—*Showing the Direction, Mean Force of the Wind, Gales, and Storms, during the Moon's Positions on Equator, North and South Stitial Colures, and the Moon's Phases, Points of Compass, and Days in each.*

Moon's Places,	SW.	W.	NW	SE.	E.	N.E.	Mean Force.	Gales.	Storms.
Moon on Equator, N. and S., Stitial, ...	58	16	14	15	3	16	4¼	7	5
Moon's Phases, ...	44	10	15	14	4	9	3⅛	7	0
Difference in favour of Moon's Positions,	14	6	...	1	...	7	1½	0	5
Difference in favour of Moon's Phases,	...	...	1	...	1	...	...	...	...

From Tables Nos. I. and II., we find the difference of the barometric readings, both in their risings and fallings, to be a minimum, the former being only 0·122, and the latter only 0·055 of an inch, which are nearly inappreciable amounts. The difference between the thermometric readings, the risings being 10·33 degrees in favour of the moon's phases, and the fallings 3·6 degrees in favour of the moon's positions.

The rain also shows 1·22 inch in favour of the moon's positions, and the number of wet days only two in favour of the moon's phases, so that the disturbance when the moon crosses the equator is much less than the theory seemed to warrant.

Table III. shows that both the winds and their force have a decided majority with the moon's positions over her phases. The gales are even, but the storms are in favour of the moon's position; and hence, Lieut. Saxby's theory may be said to be correct, except in the rain-fall; only nine inches have fallen during the year with the moon's influence—the actual fall being seventeen inches; hence, the other eight inches are due to some other influence.

It is the opinion of Sir John Herschel that the chief influence the moon exerts on our atmosphere, is to clear off the clouds on the night of full moon, and the nights immediately preceding and following.

Result of Sir John Herschel's lunar influence:—

January 4,.....Wind and Rain.	June 30,.....Clear.
Full Moon,.....Wind and Rain.	Full Moon,.....Clear.
January 6,.....Cloudy.	July 2,.....Clear.
February 2,.....Cloudy.	August 27,.....Cloudy.
Full Moon,.....Clear.	Full Moon,.....Thunderstorm.
February 4,.....Cloudy.	August 29,.....Clear.
March 4,.....Clear.	September 26,.....Clear.
Full Moon,.....Clear.	Full Moon,.....Cloudy.
March 6,.....Cloudy.	September 28,.....Clear.
April 3,.....Cloudy.	October 25,.....Clear.
Full Moon,.....Cloudy.	Full Moon,.....Cloudy.
April 5,.....Cloudy.	October 27,.....Cloudy.
May 2,.....Cloudy.	November 24,.....Cloudy.
Full Moon,.....Cloudy.	Full Moon,.....Clear.
May 4,.....Clear.	November 26,.....Cloudy.
May 31,.....Cloudy.	December 24,.....Cloudy.
Full Moon,.....Clear.	Full Moon,.....Clear.
June 2,.....Clear.	December 26,.....Cloudy.

The nights were clear on fifteen occasions, and cloudy on twenty-one; hence, this use of the moon is a failure.

No. V.

ASTRO-METEOROLOGY, OR THE METHOD OF PREDICTING THE WEATHER BY THE (STARS) PLANETS.

"Stars teach as well as shine."

"Here beauteous worlds their circling course pursue,
Here suns, unfelt, effulgent, meet the view;
While myriad orbs by myriad orbs still crown'd
In life-diffusing radiance shed around;
Of countless modes of BEING mark the trace,
Through all the dread magnificence of space."

"Omnium horarum homo."

"The works of the Lord are great, sought out of all them that have pleasure therein."

This subject is so vast in its operations and so important in its results, that it may require some prefatory remarks to introduce it to the attention of not only the general reader, but also the philosopher and the anxious student in astral science. As it is the business of the natural philosopher to investigate the nature and properties of all substances, whether in the gaseous, the fluid, or the solid state, as they exist around him, so it is the province of the astro-meteorologist to investigate the laws by which it is supposed the connection exists between solar, planetary, and cometary bodies, and their influence upon each other. Hence, the truths of this branch of physical science depend entirely upon matter of fact, or upon such knowledge as may be acquired by daily observation and continuous experiments; and, therefore, not upon the results arrived at by any process of mere reasoning, howsoever powerful or howsoever continued such reasoning may be. Astro-meteorology is one of the most extensive and interesting, and is also one of the most useful branches of physical research; so con-

sidered, it has occupied the attention of the master minds of all ages. As it is the business of the meteorologist to observe, to register, to classify, and to compare the ever-varying phenomena of the earth's atmosphere, so it is equally the business of the *astro*-meteorologist to observe, to record, to classify, and to compare the seeming connection between atmospheric phenomena, and the positions, motions, physical constitutions, and the nature of light, as reflected from the sun, moon, planets, and comets that make up our solar system. This sublime study, therefore, cannot fail to ennoble the minds of those who steadily pursue it, for it will bring them, as it were, into immediate contact with infinite wisdom and majesty; and thus, it will exalt the human character, refine its nature, and impress with the stamp of unity God's noblest work—man. Hence, he who studies nature with a reverential feeling, obtains a full conviction of the wisdom, power, and goodness of the Creator, and therefore unhesitatingly exclaims, with deep emotion, "The voice of nature is the voice of God." The astral student who examines the works of nature with a well-directed mind, finds, as he advances into the arcanum of creation, that—

> "There is
> A tongue in every star, that talks with man,
> And woos him to be wise."

In order to heighten the sublimities of the study of nature, let us take a glance at the other side of the picture, and gaze on him who scarcely brings any of his faculties into useful activity, the animal propensities only excepted, and whose mind is consequently in a state of heathen darkness. In such a one we behold an object, viewed as man, in a far worse condition than the brute, or even the meanest reptile on which he treads; and for this reason, that he is a responsible being, and accountable to his Creator for

the right application of all the powers with which he is endowed. He who possesses knowledge possesses power, and he who neglects to employ his talents in the acquirement of it is weak and imbecile in the extreme. But, if knowledge is power, we may with equal emphasis pronounce it to be truth, and herein should be found at least one source of happiness. If, then, the right use and application of truthful knowledge results in individual happiness, so, whether it be scientific or otherwise useful, its diffusion must promote the general welfare of mankind, and hence—

"Truth shall triumph."

This produces in the mind a state of "peace which passeth all understanding"—a peace which may be felt but not described. It is as though every fibre of the soul breathed joys, and rapturously exclaimed—

"These are the joys which satisfy
And sanctify the mind;
Which make the spirit mount on high,
And leave the world behind."

Astronomy, the basis of Astro-Meteorology, is not only one of the most ancient, but also one of the most perfect of the practical sciences. It can be traced back to the earliest periods of history; its application was to measure the parts of the year, the return of the seasons, and the division of time into months, days, hours, &c. "To every thing," says the wisest of men, "there is a season, and a time for every purpose under the heavens." (Eccles. iii. 5.)

One of the present applications of astronomy—and one of equal importance with those just named—is the return of meteorological phenomena, as regards the seasons of the year, which application has been justly named *Astro-Meteorology*.

When we contemplate the entire celestial vault, studded

with its shining orbs, all moving in silent grandeur like one vast concave around our little globe—the platform on which we stand—we who possess reflective and intelligent minds, are led to ask ourselves: Whence come these shining orbs that seem to rise in the east and set in the west? Do they shine with a borrowed light, or by their own native brightness? By what laws are they regulated? What purposes are they destined to fulfil in the grand scheme of this mighty universe? Are they placed there merely for the inhabitants of this earth to gaze at, or are they destined to render this globe a happy place for God's intelligent creatures to worship and adore their Creator?

The last question brings me at once to the subject I feel it necessary to discuss, in order to fully comprehend the beauty, the harmony, and the utility of Astro-Meteorology, viz., the nature, constitution, and uses of each body composing our solar system, the modes of planetary action, and the results of such action upon the atmosphere of our globe.

"THESE ARE A BOOK IN WHICH WE ALL MAY READ."

The air is, of all the elements with which man has become acquainted, the most necessary to our existence. It is by means of the atmosphere that respiration is carried on. The great changes to which the atmosphere is subjected have led man to contemplate their causes, and, as far as possible, to guard against any evil effects that might arise from any sudden changes taking place. Hence, the object of their contemplating is to inquire how or by what influences are those changes produced?

We must bear in mind, that the atmosphere envelopes our globe to the height of nearly fifty miles, the temperature of which, as a natural law, diminishes with its height; yet this law is very often found interfered with, for example:—

On the 12th of January, 1864, Mr. Glaisher made an experimental baloon ascent, the air being 40 degrees when he left the earth. On arriving at the region of clouds, he found the thermometer reading 43 degrees, which I account for thus:— The direction of the wind on the surface of the earth was N. E. On the morning of the 10th, I observed a S. W. current in the region of cloud, by the scud passing over the sun's disc from that quarter. This state of things continued till the morning of the 18th, when the S. W. current descended to the earth and raised the temperature to that occupied by the clouds; thence, it follows that although all our astronomical and philosophical books teach us that the air diminishes in temperature according to its altitude above the surface, facts shew us that such a law does not hold good; and hence, many phenomena occur which seem to contradict general laws, and stagger the philosopher, who asserts, "that the higher a body ascends in the atmosphere the greater is the quantity of heat extracted from it." This fact can only be the case in the absence of upper southerly currents which gradually increase the temperature of the lower strata of the atmosphere, and produce those anomalies which are frequently met with. At the same time, we can always find snow-capped mountains, even in the torrid zone, at whose bases the orange and citron blow and bring forth their fruit to perfection, and where man pants under the overwhelming heat of a burning climate. The atmosphere, however, is heavier near the surface of the earth, where it has to support the air above it, and which is found to press with a weight of 15 lbs. on every square inch of surface the entire globe contains.

But this atmosphere, in which man and animals

"Live and move and have their being,"

is so massive, that when it is put into violent motion by dis-

turbing currents of electricity—excited, as we proceed with our subject, by solar, planetary, and cometary influences—whirls about the greatest ships on the ocean like mere toys, sweeps away cities like chaff, uproots the sturdy oak like a mere blade of grass, and hurls destruction throughout its path. Anon, it is so mobile that thousands have lived years in it, being scarcely conscious of its existence, while tens of thousands are possibly ignorant that they exist in an ocean of air, as the finny tribe exists in an ocean of water. Its mighty force can shiver iron bars before it like glass; yet so gentle is it at times that the little child's soap-bubble sails through it with impunity, whilst the most minute insect turns it aside with its tiny wings. Such indeed is the value of the atmosphere that it ministers extensively to our senses; the warm south breeze restoring colour to the pale cheek of the invalid, the fresh westerly breezes cooling the fevered brow, and the northern blast bracing the nerves of the children of our rugged climate into full strength and manly vigour.

This is the arena in which the astro-meteorologist finds the great changes of pressure, temperature, drought, moisture, electrical displays, heat, cold, &c., which he believes owing to the influence of the sun, moon, planets, and comets.

Having shown upon what principles astro-meteorology is based, the duties of the astral student, and the arena for his observations, we shall, in the next paper, come to the science itself, and endeavour to point out how our atmosphere becomes subject to changes of pressure, temperature, &c., and through what agencies these changes are produced, so as to arrive at the laws of predictive meteorology, and the great advantages such a system of prediction offers to the mariner, the agriculturist, the tourist, the horticulturist, and indeed to all those whose vocations are performed in the open air.

No. VI.

THE SUN.

The central star of the solar system, which is the source of light, heat, electricity, life, and motion, and probably of other emanations of which man is at present ignorant. This sun is calculated by astronomers to be five hundred times larger than all the planets that revolve round him taken together. What a focus for celestial influence! This vast body is stated to be, in round numbers, ninety-five millions of miles distant from the earth; but some very modern astronomers have computed its distance at only ninety-one millions. This difference of distance will not affect the theory of Astro-Meteorology, since all the planetary effects are presumed to be due to reflected light—the planets all being opaque bodies, and receiving their light from the sun. The sun's diameter is computed at about 880,000 miles; hence its circumference is $2\frac{3}{4}$ millions of miles, and its surface contains about $2\frac{1}{2}$ billions of square miles. The magnitude of the sun is stated to be 12·360 times that of our globe. To this grand reservoir of vitality the earth is indebted for its warmth; vegetation for its luxuriance; flowers for their brilliancy of colour and perfection of odour; fruits for their ripeness and rich flavour; and the whole animal creation for life, enjoyment, and plenteousness. This sun dispenses light and warmth to every planet of our system, each of which possesses a constitution of its own, and which is capable, in its turn, of dispensing its own influence to every other planet; and thus, under the control of the sun, a perpetuity of motion is sustained throughout the entire system, giving it stability,

and proving it to be the work of an all-wise and all-powerful Creator. Hence—

"All Nature
Moves by certain laws that rule the vast machine,
In each degree of change, and speaks a power
That gives it motion, and directs the parts
To their respective ends: for things inert
Could never act without a living soul
To give them energy. Were it not so,
The orbs of heaven would cease to roll, the air
Forget to breathe, and the earth refuse to yield
Her various fruits."

I know the objectors to the power of reflected light (I was once one myself) will argue the impossibility of bodies placed at so great a distance from the earth and sun, as the planets and comets are, having any influence upon the earth, or upon its atmosphere. But, reader, peruse, and try to answer *no* to the following questions:—

"When we survey yon circling orbs on high,
Say, do they *only grace* the spangled sky?
Have they *no influence? no functions given?*
To execute the awful will of heaven?"

It is, however, not only a well-attested fact, but allowed by the greatest of sceptics in *astral* philosophy, that the solar rays influence the waters of the ocean. Now, were space a vacuum, as the ancient philosophers taught, sceptics might have some show of reason for their objections; but modern philosophy has taught man that space is filled with a rare but imperceptible medium, probably of an electrical character, which extends over the entire universe, fills all space, and enters freely into all bodies. Hence, it acts as the conducting medium between all bodies composing, not only our solar

system, but the boundless universe, and reaches to the very

"Frontiers of creation's vast dominions,"

even to the farthest depths of space, where all the gorgeous assemblage of suns and worlds—invisible to the naked eye, or even when assisted by the telescope—perform the high behest of their Creator, where—

"All thought is lost and reason drowned
In the immense survey;
We cannot fathom the profound,
Nor trace Jehovah's way."

Astronomers tell us that this etherial fluid offers no resistance to the planets and comets in their progress in space, because it is so extremely rare. I therefore consider it to be neither irrational nor unphilosophical to conceive that both planets and comets, in their motions in space, diurnal and annual, may give to this medium a wave-like motion, which motion, from the exceeding rarity of the fluid, will continue, like the waves produced by plunging a heavy substance into a lake of still water, following each other in rapid succession, and at the same time continually expanding their circular dimensions, till they come in contact with some denser medium. In other words, this wave-like motion or agitation is produced in the ethereal fluid, either by the central velocities of the planets and comets, or by the velocity of their reflected light, till it comes in contact with our atmosphere, and the atmosphere of other planets, which are constantly and uniformly traversing space, and thus forming various angular positions with each other, and with the sun; and as, I think, we may philosophically infer that the atmospheres of the different planetary bodies are of different magnitudes, densities, and probably compositions, it will not be doing any violence to

philosophy, or injustice to science, to conceive (although not mathematically demonstrated) that the electricity of the earth's atmosphere may become disturbed in proportion to the magnitude, density, velocity, quantity, and quality, of the light reflected from the several planets and comets of the solar system. And further, I consider also, that that agitation is quite capable of producing these varied results, as witnessed in the daily changes of temperature, pressure, wind, rain, storms, electric currents, and other atmospheric phenomena, which never could take place were the sun the only acting agent of our system. Nay, I do not think it unphilosophical or even presumptuous to ascribe to the same source, the refreshing dew—the fertilizing shower—the pinching frost—lightning's vivid flash—the thunder's awful roll—the destructive hurricane—the overwhelming flood—the desolating earthquake. All, all are the results of those powerful electric agents, acting in stern accordance with the laws established in the eternal councils of creative wisdom, for the health and reproductiveness of the whole organized creation. But—and here man's puny wisdom shrinks before the grand, celestial ordeal, which interrogates it in the following sublime and philosophic strain—

"Canst thou perceive
How causes operate? What latent springs
Move nature's works? Know'st thou what rounds the ball,
Or points the flaming dart? how the hoar-frost
Is formed of pearly dew? how icy chains
Restrain the fluid mass?"

These, and such like questions, sublime as they are, the astro-meteorologist has sought to answer by planetary influence, seeing that the earth *per se*, and the surrounding atmosphere *alone*, could not furnish a reply.

Inquiring man contemplates the agencies employed by

the All-wise Creator to carry on his eternal purposes for the comfort and happiness of his intelligent creature—MAN.

That solar system, of which our earth forms but a very small fractional part, is itself but a very small portion of the entire universe, "whose centre is everywhere, and circumference nowhere," as cognizable by the senses of man, or within the view of mortal intelligence.

The construction of such a system is the work of an Architect who commands exclusively for Himself, both omnipotence, omniscience, and omnipresence; and hence, His works are so complete that they can never get out of order; never require any new adjustment; and, therefore, as the Royal Psalmist sings, "The heavens declare the glory of God, and the firmament showeth forth His handiwork."

As the solar system, then, is but an atom amidst the myriads of systems that make up the vast universe, where "systems upon systems roll," and is constructed upon such unerring principles of harmony, wisdom, goodness, and perfection, it is not possible—so far as human intelligence can penetrate—for any portion of that system to be cut off or destroyed without disarranging the whole; and hence, I feel assured that true philosophers must look at the entire machinery of creation, before they can pronounce that one portion of it is not inseparably dependent upon another, by some physical property or law, some subtle agency, perhaps not yet revealed to the keenest penetration of the loftiest intellect of man. The following are questions not readily answered, even by the most profound philosopher or the most recondite mathematician:—

"Where ends this mighty building? where begin
The suburbs of creation? where the wall
Whose battlements look o'er the vale
Of non-existence—Nothing's strange abode?
Say, at what part of space Jehovah dropped
His slackened line, and laid his balance by?"

Yes, courteous reader—student of creation's mighty works—creation's dominions extend through the infinite regions of space, and are governed, sustained, directed, regulated, and eternally perpetuated, by the wise, perfect, harmonious, and undeviating laws of HIM—

> "Whose mighty arm sustains the poles
> On which the huge creation rolls."

Indeed, the true philosopher, in his most extended penetrations into the abyss of space, sees the beneficent results of wisdom framing and directing the laws of creative majesty, and exclaims, in the rapture of his soul—

> "I cannot go,
> Where universal love not smiles around.
> Hence, sang the royal psalmist, addressing Jehovah,
> Thou hast made the heaven of heavens, with all their
> Hosts; the earth and all things therein; and the
> Host of heaven worship Thee."

At first sight, these questions would seem to say, It is in vain for man to pursue this abstruse and intricate subject further; but the book of creation is written in legible characters, and invites man to the study of the works of his Creator, feeling assured that the more he knows of the works of creation, the nearer he will come to his Creator.

No. VII.

THE PLANET MERCURY ☿.

Very few works on astronomy notice the physical properties or constitutions of the planetary bodies, but confine their observations to mathematical astronomy, which involves

a deep knowledge of synthetical computations and geometric delineations; hence it is, that very few are found to step out of the beaten path; and hence it is, also, that to thousands of persons astronomy is almost a sealed book. Its teachings are chiefly confined to the sun on the meridian; the moon and moon-culminating stars; the inferior (why not interior?) planets, Mercury and Venus, on the meridian; and the superior (query, exterior) planets, Mars, Jupiter, Saturn, Uranus, and Neptune. The last only observed occasionally, and on Sundays no observations whatever are made. These observations are chiefly made with a view to the correction of time (sometimes amounting to the fraction of a second), and are never of general utility. Especially are they of no use to the astro-meteorologist, whose business it is to contemplate the planets' positions as messengers of creative wisdom, to guard man against impending weather which might prove to his disadvantage, and to instruct him when to carry on his operations without hindrance or loss.

The planets are donated by the same symbols as those used by the ancients, and as used by them in their mythological writing. As it may happen, however, that these symbols may not be known to some readers of these papers, it may be as well to insert them here. They are ☿, Mercury; ♀, Venus; ⊕, Earth; ♂, Mars; ♃, Jupiter; ♄, Saturn; ♅, Uranus; ☉, Sun; ☽, Moon. The aspects (or positions) are also here named:—☌, *conjunction*, or on the same meridian; □, *square*, three signs, or 90° apart; △, *trine*, four signs, or 120° apart; ⚹, *sextile*, two signs, or 80° apart; ☍, *opposition*, six signs, or 180° apart; p. d., *parallel declination*, or two planets having the same or opposite degrees of declination, as 10° north or 10° south, &c.

These angular distances, denominated "aspects," are the means by which astro-meteorologists consider that planetary communication is effected; and it is so effected on an optical

principle, viz., that when two persons are placed in certain positions invisible to each other, they shall, by the introduction of a mirror at the relative angle of vision, behold each other simultaneously. This is considered to be their connecting medium; and so, in like manner—or in other words, upon the same optical principle—the more directly the angle of vision, the stronger the interchange of planetary influence. Hence the aspects are divided into three classes, viz., *solar aspects*, *lunar aspects*, *mutual aspects*. Their proportions of angular forces are considered to be—1st, conjunction or opposition; 2nd, sextile or square; and 3rd, trine. There are also some minor aspects, which will be noticed hereafter in a tabulated form.

Solar aspects are formed when the earth and another planet (whether inferior or superior), arrive, during their respective courses, simultaneously at the corresponding angles of the eight above-named aspects, both towards the sun and each other; and thus, the two planets are said to form the solar aspect.

Lunar aspects are formed in the same manner as the solar aspect, except that the moon takes the place of the sun. These aspects are of a second-rate power.

Mutual aspects are formed by the earth and any two other planets, irrespective of the sun, arriving in similar positions to each other as the sun, earth, and one planet. These are of third-rate power.

It must, however, be borne in mind that the reciprocated aspects here described, or as we may term them, aspectal influences, are, in every instance, of a very varied nature, and consequently produce very varied results, as every planet possesses and diffuses its own distinct properties. But to render this subject more familiar to the general reader, it may be well to illustrate it thus:—When any number of bodies travel in the same direction, yet at different distances

from a common centre (as, for example, from the sun), the rate of the revolving bodies increasing in relative velocity with a decrease of relative distance from that common centre, some of those bodies must always be on one side of the said centre and some on the other; yet very frequently two among them will be travelling precisely opposite to each other on their respective sides.

But to return to our planet Mercury. It is not only the smallest of the primary planets (the asteroids excepted), but it is also the nearest body to the sun, as at present determined. It revolves at a mean distance from the sun of 37 millions of miles nearly, and with a velocity of 110,000 miles per hour, nearly double that of the earth. It is the most dense in its nature of all the planets yet discovered, its estimated weight being equal to a globe of lead of the same dimensions. Its diameter is 3,200 miles, and consequently its surface contains 32 millions of square miles. The size of Mercury is therefore about one-fifteenth that of our earth. His days and nights are nearly the same length as our own at the equatorial regions, but the whole cycle of his seasons is run through four times to only one cycle of the earth. It is a well-attested fact on our globe that bodies receive their amount of light and heat in proportion to the squares of their distance from the luminous object. If, therefore, we divide the square of the earth's distance from the sun by the squares of Mercury's distance, we shall find a quotient of nearly seven and a-half; hence, it is considered that the heat and light in the planet Mercury are seven times as great as those on the earth. If, then, we take the annual temperature of the earth at 50 degrees, Mercury must have a heat equal to 350 degrees, or 138 degrees hotter than boiling water—a temperature which cannot be considered in any way adapted to the sustentation of animal or vegetable life. But if we regard the physical construction of Mercury,

we find, as stated by the German astronomer, Schrôeter, that that planet has not only spots on its surface, as exhibited by the larger and more remote planets, but that it has some very elongated mountains. The heights of two of these have been determined, one being a mile and 372 yards, and the other $10\frac{3}{4}$ miles: the latter being more than four times the height of Teneriffe. Mr. Schrôeter also states that these two, with several other mountains, are situated in the southern hemisphere of that planet. Hence, it is supposed that if such mountains are ever snow-capped, the southern portion of Mercury being turned towards the sun every 88 days, those snows are then melted, and the valleys beneath rendered not only salubrious, but in other respects well fitted for the abode of rational beings. The same intelligent astronomer informs us, moreover, that from observations made by him on the horns of Mercury, when in its crescent form, the diurnal rotation of that body would be 24 hours and $5\frac{1}{2}$ minutes.

These and other minute and valuable discoveries will, no doubt, startle some persons, by whom they will be regarded as lying far out of the pale of mortal ken—as exceeding, indeed, the utmost range of human investigation. But the discoveries of the immortal Newton have taught us the laws which regulate the influence of the planetary bodies upon each other, their physical effects depending on the quantity of matter each contains; so that we are enabled, by observing their effects, to reason mathematically and rationally on the subject, and thereby to determine, with tolerable accuracy, the meteorological effects produced by each planet upon its fellow-planet, and thus, also, each planet's effect upon our own earth. Hence—

"To study God, God's student, man, was made,
To read Him in His Nature's text conveyed;

Not as in heaven, but where he did descend
To earth, his easier book, where to suspend
And save his miracles, each little flower
And lesser fly show his familiar power."

It is, however, not only in this *easier book, the earth*, that man is required to study his Maker; he will find his *stupendous works*, the celestial bodies, equally worthy of his studious attention, and much more sublime in their results; for we have already said that—

"Stars teach as well as shine."

Hence, says the old, but by no means ignorant, writer on the sublimity of the Creator's works:—

"I'll not believe that the Arch-Architect,
With all these fires the heavenly arches deck'd
Only for show, and with these glittering shields
T' amaze poor shepherds watching in the fields;
I'll not believe that the least flower that ranks
Our garden-borders or our common banks,
Or the least stone that in her warming lap,
Our mother earth doth covetously wrap,
Hath some peculiar virtues of its own,
And that the stars of heaven have none."

No. VIII.

VENUS ♀.

"Fair morning star,
That leads on dawning day to yonder worlds,
The seat of man."
"Sweet evening star—fair Venus shines
Even in the eye of day."

With the exception of the sun and moon, Venus is the most splendid of all the celestial orbs of our system, and is

now a morning star; but, in consequence of the twilight at the beginning of March, it is not so conspicuous an object as it was in January and February. When Venus shines with her greatest lustre, she appears like a brilliant lamp suspended amidst the less noticeable orbs of heaven.

Shepherds, poets and philosophers, in all ages, have been loud in their praises and admiration of this planet. The Greeks called her *Phosphor* when she rose before the sun, and *Hesperus* when she adorned the western sky after sunset; but we content ourselves by simply calling her the morning or the evening star. The evening and morning stars were by the ancients supposed to be different stars, but Pythagoras was the first to disclose their identity. Thus sang Milton—

> "Now came still evening on; and twilight grey
> Had in her silver livery all things clad;
> Silence was pleased; now glowed the firmament
> With livid sapphires; *Hesperus*, that led
> The starry host rode brightest, till the moon
> Rising in clouded majesty, at length,
> Apparent queen, unveiled her peerless light,
> And o'er the dark her silver mantle threw."

I have seen Venus at noon-day, with a good telescope, and sometimes in the day-time with the naked eye, and several times during solar eclipses. Venus, like Mercury, is never to be seen at midnight, because her elongation is not more than 47 degrees, either E. or W. of the sun; hence, she always sets before midnight. Venus, like Mercury, also, passes through all the phases of our moon; but when she exhibits her *full orb*, she is then, like Mercury, in her superior conjunction, or nearly double the distance from us that she is when in her inferior conjunction.

Copernicus, long before the invention of the telescope, predicted that the *phases* of the interior planets, Mercury and

Venus, would one day be discovered to be similar to those of the moon. These phases were discovered by Galileo, in 1611, after he had completed his astronomical tube—the telescope. This prediction and its fulfilment afford the strongest and most convincing proofs of the Copernican system.

Venus is about 68 millions of miles from the sun, at her mean distance, and only 27 millions of miles from the earth at her inferior conjunction, which differences of distance will readily account for difference in the appearance of her size, for when she is at her superior conjunction she is then 163 millions of miles from the earth.

Venus is a little less than our earth, her diameter being 7800 miles; her surface, therefore, contains 191 millions of square miles—a fine focus for distributing her soft and gentle beams of light. She passes through all her phases in 224 days, the length of her year; but as the earth moves on in its orbit, in the same direction, the time that must elapse before Venus can overtake the earth, so as to occupy the same conjunctive position again, with respect to the sun and earth is 584 days. Venus revolves on her axis in 23 hours 21 minutes. She is at her greatest brilliancy 70 days before and 70 days after her superior conjunction.

PHYSICAL CONSTITUTION OF VENUS.

Schrôeter, who made numerous observations on this planet, concluded that Venus had an atmosphere of considerable extent and density. He says its atmosphere extends to a great height; the dense portion of it he estimates at 16,020 feet, and rising far above its highest mountains. Spots have been seen on this planet by many astronomers, and even by myself, when looking at the planet in the daytime. On some occasions, the boundary between the dark

and the illuminated hemispheres has appeared uneven or jagged, similar to that of the moon, which affords, I think, a very clear proof that the surface of the planet Venus is diversified by lofty mountains and deep valleys. Indeed, Schrôeter measured one mountain to be eleven miles in altitude, and another nearly double that amount. The great elevations, like those of the moon, are in her southern hemisphere. The future transits of Venus, may, with superior instruments, and in the hands of able and experienced observers, either verify the above altitudes or correct them.

As water on these distant orbs presents to us a darker hue than the land, it does not appear that any very extensive oceans or seas exist on the surface of Venus, notwithstanding that from the numerous observations already made, there must be a very great diversity of surface.

Venus, then, being but a little less in magnitude than the earth, must hold a conspicuous rank in the solar system, and also in the empire of the almighty Creator (if I may indulge such a thought), far surpassing that of our earth's, both in point of beauty and sublimity; and, as I think, without doing injustice either to reason, science, or philosophy. I may add, in population too; for the light and heat of Venus are nearly twice as great as they are on the earth's surface—the length of her day being about $23\frac{1}{2}$ hours.

I think no rational mind can conceive such a magnificent body, furnished with every requisite for the support of animal life, created for no other purpose than to be gazed at by the inhabitants of our globe, millions of whom do not know that such a planet even exists at all.

I feel persuaded it will not be doing violence to astronomical science to suppose that the atmosphere of the planet Venus is eminently calculated to reflect the solar rays to our planet with peculiar force and splendour; for its light in the

day-time, when seen through a telescope, is so intense as to render the planet distinctly visible; while during the night its brilliancy so overpowers the eye as to render its service not distinctly visible. Were we to indulge our vivid imaginations in contemplation on the beauty, the glory, and the magnificence of this planet, we might not only become dissatisfied with our own earth, but we might picture to ourselves that Venus was inhabited by a race of intelligent beings, as far outstripping ourselves in form and intelligence, as the scenery of Venus exceeds that on our earth.

But on these subjects we need no longer speculate, neither with regard to this nor any other planet, for knowing the omnipotence of creative power and wisdom, we may rest assured that, in this planet, as on every other, the structural forms and features of its inhabitants, planets, animals, &c., are exactly adapted to the nature of their habitation.

My next paper will treat of Venus as a meteorological agent.

No. IX.

VENUS AS A METEOROLOGICAL AGENT.

The year 1863, as well as those which preceded it, has proved most satisfactorily that the planetary system, contemplated astro-meteorologically, is the great wheel of nature, and its motions demonstrate that all physical operations are regulated by it, and are as perfect as the laws which regulate planetary and cometary motion. But man, from his prejudices against anything which he terms an innovation into the beaten paths he and his forefathers have had for centuries, he will not give himself the trouble to investigate it. Was it not so with Galileo when he asserted that it was the earth's motion on its axis, and not the re-

volution of the sun, moon, and stars round the earth, that produced the phenomena of day and night? His reward for this important discovery was banishment for life from his native country, when he was seventy-two years of age. What he then asserted has been proved to be a fact. Thanks to the great and wise Creator, the laws of our country are not so stringent now, as they were in the days when priestcraft held the reins of science, and punished every one who dared to think for himself.

It is, however, a well-known fact, that every promoter of a new, or seemingly new branch of philosophy, always meets with opposition; and so will every pioneer in astral philosophy (of which I confess myself to be a very humble one), till the science becomes either more generally studied, or its principles zealously advocated by some great acknowledged authority, as an Airey, a Herschel, a Hind, or a Brewster; then every little observer will fly to their assistance, and further their views in every possible way. Well, if this, and several other attempts I have made to benefit the agricultural and other interests, with one of the greatest boons science can confer on them, shall pave the way to grand and satisfactory results, science will be extended, mankind benefited, and my labours triumphant.

METEOROLOGICAL TESTS OF THE INFLUENCE OF VENUS.

It is the opinion of astronomers that both Mercury and Venus are enveloped in cloudy atmosphere, that serve not only to mitigate the intense light and heat to which they would otherwise be subjected, and that it is only the reflection of light from these dense atmospheres, and not from the solid bodies of the planets themselves that we observe, and to which we attribute the phenomena recorded at that time. Now, the astro-meteorologist considers, that when any planet,

whether interior or superior, holds dominion of itself, that is, when it is in aspect or angular position with the sun and earth, without any other celestial body interfering, strict regard should be had to the nature of that planet. Thus, Venus in aspect with the sun and earth, produces in spring, mild damp weather—in summer, rain, sometimes attended with thunder—in autumn, small rain, or very wet mists—in winter, rain or snow, according to the temperature at the time—generally, falling barometer. The following are the tests for 1863 :—I find only six occasions with a free aspect, viz., the sun and Venus 30 degrees from the earth—on all these occasions there was a falling barometer and rain. July 7, sun 45 degrees from Venus and the earth, and the time of a series of hot and dry days; there was no rain, but a strong sea fog and a falling barometer. Sept. 28, sun in conjunction with Venus and the earth—rainy day, falling barometer, and a fall of 60 degrees of temperature. There is one case out of six in which there was no rain, and that was during the hottest period of summer. On the 11th of May, 1861, Venus in conjunction with the sun and earth—heavy falls of rain and rapidly falling barometer were recorded in all parts of the kingdom.

The student in Astro-Meteorology must not rest perfectly satisfied by looking at the effect of any single planet in our system, when it is in either solar, lunar, or mutual aspect alone. He will often find results at variance with each other; therefore, he must be careful to watch the effects of similar aspects in different zodiacal signs, which must produce various results, of greater or less potency, according to the season of the year; for example, aspects formed when the sun is in the sign Aries, and just passing into northern declination, thunder is not an unusual phenomenon, attended with rain or hail—to wit, during the first ten days in April, 1860. We also look for the equinoctial gales about this

period. The middle portions of that month are more temperate, and the latter generally much warmer than the first. The sign Taurus seems to partake of both heat and cold, the first ten days being generally windy and cloudy, the second ten wet, and the third ten stormy. Gemini is generally warm and moist; Cancer generally produces hot and serene weather; but when the sun is declining from Cancer, the northern tropic, we frequently find hot winds and dry air. The sun in Leo frequently produces heat, warm nights, and towards the end of the sign, wet. Libra is generally a warm period; and when the sun recedes to the south of the equator we anticipate equinoctial gales and rain. Scorpio is generally a turbulent sign, when the electricity of the air strives to equalise itself "over earth, sea, and sky," which generally terminates in considerable downfall, as the electricity is set on fire. Sagittarius frequently has a few electrical displays, with strong gales of wind, giving, very frequently, unmistakeable sights of approaching winter. Capricornus and Aquarius are generally winter months, attended, as in the present year, with severe frosts, and sometimes heavy snows. Pisces generally produces brisk wind and rain, so as to introduce us gradually to spring again. Therefore, from this brief sketch of solar action during each month of the year, due regard must be had, not only to the sign, but to that portion of it in which the planetary bodies are moving at the time of the aspect, and the judgment must be founded accordingly. These cautions will be necessary in judging of the weather under the aspect of any planet, for we cannot suppose that the influence of any planet can overpower the influence of the sun, since his influence is greater than that of all the planets put together, if the Newtonian laws of gravitation be true; and I see no reason to doubt the results of the "immortal Newton."

One more caution I would give the astral student; he must not look for the effects of any aspect on the exact day of its completion; it will sometimes become apparent a day or two before, sometimes a day or two after the aspect is formed, especially if there be any antagonistic aspects near forming. The effects of locality, too, as dry and warm soils—dry and cold—moist and warm—or moist and cold climates.

These general rules, applied to each planet, under their several aspects, regard being had to the planet's power, and whether it be aiding or antagonistic to the aspect formed, I think, will greatly aid the student in this sublime science.

No. X.

THE EARTH ⊕.

We are now arrived at the *habitation* of what has often been most truly styled the noblest of the Creator's works, MAN. The birth-place, the cradle, the abode, the home, and the grave of the whole human family, for the period of six thousand years! Looking at the earth in an astronomical point of view, we find it to be the third planetary body from the central orb, the sun, and the first of the solar system of which we possess any certain knowledge of the existence of intelligent creatures. But, say some of those sceptical beings, who look upon everything around them as the result of chance, "How do you know?" or, "What proof have you that the earth is a planetary body, or that it bears any resemblance to those glittering orbs that bedeck the canopy above us?" That any affinity should exist between our earth and the stars of the firmament seems to be a palpable absurdity to the minds of those who are blindly

ignorant. "The stars," say they, "are mere shining points in the sky, while our world appears boundless in extent, and exhibits no brilliancy, compared with theirs, to our senses!" "Nay," say they, "the earth is an inert mass of matter, and utterly incapable of possessing the least shining quality. The only motion we can discover are the tossings of the seas in their beds, the flowing of the rivers in their channels, or the trees bending to the overwhelming blast; but the starry host appear to be constantly changing from place to place in the rich canopy above us, some of which sometimes disappear for months together, and then return again to our view." To an intelligent and properly cultivated mind, however, it will not, I think, be very difficult to demonstrate, that the apparent quiescent state of man's habitation is that of an unceasing traveller in the unfathomable realms of space; that the dark, opaque mass presents the same luminous appearance to the neighbouring planets as they do to us; that in its physical constitution it is in close relationship to the other planets of our system; and that it may, with the strictest propriety, be denominated a star or rather a planet (a wandering star). To the uneducated and unscientific eye, the earth certainly represents an immense plain, stretching out indefinitely in every direction. In early times, that is, in the very infancy of astronomical science, this was indeed the current opinion, and it seemed to be a very rational one. A few simple facts, however, served to dispel the delusion of the senses. It must, notwithstanding, be admitted that the boundary of the vision of the mariner at sea, or a traveller on land, is a well-defined circle. In which portion, soever of the earth's surface, or on the ocean's bosom, the observer is placed, it is the centre —a fact which, if geometrically proved, would show that the body to which it relates must be of a globular figure. For in whichsoever direction a ship may leave the shore, or from

whatsoever point it may approach the land, the ship is always observed as if making into the ocean on its departure, or rising from the bosom of the deep on its approach, giving demonstrable evidence that the water presents a convexity between the eye of the observer and the departing or approaching ship. A further demonstration of the earth's convexity is most clearly presented to our view during an eclipse of the moon, for the shadow of the earth, which is projected upon the moon's disc, is always of a circular form; and the most ignorant rustic knows that the shadow of any object is a correct resemblance to the object itself. Another demonstration of the rotundity of the earth, is the fact, that of a vessel proceeding in one general direction, either eastward or westward, and arriving at the same starting point again. These well-attested facts prove that the globe of our earth must be either a ball or a cylinder; but the latter notion is dispelled by the fact of a vessel sailing either southward or northward; by a gradual rising of the northern constellations, as we recede from the equator towards the north pole, and a gradual declination of them as we approach the equator. The earth, then, from all these facts, must be of a spherical figure, like the other planets, whose discs are the objects of our nightly gaze, as well as of our telescopic observation. The spherical figure, not only of our earth, but of every other planetary body, is evidently the result of the immortal Newton's well-known law of gravitation; for—

"That very law that moulds a tear,
And makes it trickle from its source,
That law proclaims the earth a sphere,
And guides the planets in their course."

And this seems to our finite capacities so consonant with the wisdom and ultimate designs of the great Creator, as the most advantageous form the planetary bodies could assume.

THE PHYSICAL CONSTITUTION OF THE EARTH.

By a brief description of the surface of the globe we inhabit, we may be enabled to reason analogically, with regard to the other planets of our system, as they are all but parts of the same whole—all under the direct control and influence of our sun, from which last-named source they are alike lighted and warmed as we are; and therefore may we fairly conclude that they, like our globe, are fit abodes for intelligent beings.

The most striking feature on the face of our earth is its division into two great portions, land and water, both of which present regularity of form and appearance, their greatest length being from north to south. The divisions of land are denominated continents; that which is designated the Eastern comprehends Europe, Asia, and Africa, and extends from the Cape of Good Hope (the southern point of Africa) to the north of Kamtchatka—a distance of nearly ten thousand miles. Its breadth, from the area on the eastern extremity of Chinese Tartary, to the most westerly point of Africa, is about nine thousand miles. The other division is called the western continent, which comprehends the whole of North and South America, bounded on the east by the Atlantic Ocean, and on the west by the Pacific Ocean. The entire length of America from north to south is about 8000 miles, and its greatest breadth about 3000 miles. These different appearances of land and water will be distinctly visible to the other planetary bodies, supposing them to be inhabited by intelligent beings. The land would reflect the solar rays and appear bright to them, while the water would absorb a greater portion of the sun's rays, and therefore have a dull appearance, just as the moon appears to us, whether we look at it with the unassisted eye or with a telescope. Hence, I think, we may reasonably infer that

the other large bodies of our system are very similar to the globe of our earth.

MAGNITUDE AND MOTIONS OF THE EARTH.

The earth's diameter is estimated at 8000 miles, and its circumference nearly 25,000* miles. Its motions are similar to those of all the others. It revolves on its axis in 24 hours; hence, the inhabitants situated on the equator are carried round at the rate of 1000 miles per hour. The earth travels in its orbit round the sun at the rate of 68,000 miles per hour, at the distance of 95 millions of miles from the sun.† By the former of these motions we have the phenomena of day and night, and by the latter the seasons:—

> "Thee, nature's God!
> First source of all things lovely, all things good!
> Thou all things own! Thou speakest and 'tis day;
> Obedient to Thy Word, alternate night
> Obscures the world! The seasons at thy call
> Succeed in train, and lead the year around."

No. XI.

THE ATMOSPHERE OF THE EARTH.

The apparatus of both animal and vegetable existence on our earth is not complete without its atmosphere. Take it away, and all life, at once ceases. Pollute it, and disease in every loathsome form will be the result. What a wonderful field of inquiry there exists in the gases composing our atmosphere! I think it would be bad taste and worse philosophy were we to make anxious inquiries about

* The reader, to be accurate, must take the mean radius of the earth at 3965 miles, which, multiplied by 6·28318, will give 24,912 miles for the circumference of the earth at the equator.

† Greatest and least distances from the sun, 93,190,000 and 90,110,000 miles.

the atmospheres of the remote planetary bodies, if we were ignorant of the gases of which our atmosphere is composed, and from which, by the most wonderful contrivance of the Omniscient Deity, we breathe, and by breathing we live. For—

> "Were once the energy of air denied,
> The heart would cease to pour its purple tide;
> The purple tide forget its wonted play,
> Nor back again pursue its curious way."

This ærial appendage to our Globe, which we call the atmosphere, or giant-sphere, extends to an altitude of about forty-five miles, diminishing in density from the surface of the earth to its utmost limit of altitude. The atmosphere is invisible, yet it is in constant motion or action, affecting, in a greater or less degree, all bodies with which it comes in contact, producing most important effects, where neither its presence nor its ageny is suspected, by those who are ignorant of its properties. All respiratory existences, whether animal or vegetable, depend entirely upon it for the maintenance of their vitality; for both the mechanical functions of animals and the chemical functions of vegetables have their respective organic constructions expressly adapted for its use. The atmosphere also administers in an equal degree to our comfort, our pleasures, and convenience, in a great variety of ways. It is the only medium through which sounds are conveyed to our ears, odours to our nasal organs, and light to our eyes. What a wonderful apparatus, which nothing less than the Divine hand could have constructed, is the breathing organs, or lungs, and the lungs of the lower animals, which are so adapted as to act chemically upon the atmosphere, in just such a manner as to impart to the blood that principle by which life is sustained and carried on with vigour! How admirably, too, are the organs of voice adapted to impress on the atmosphere those harmonious

pulsations which convey its sound so accurately to that sensitive organ—the ear! That we may the better understand the utility of the air which surrounds and enters within us, as regards both our pleasure and convenience, let us just suppose that we could exist for a few hours without the atmosphere; we should immediately find that how perfect soever might be our organs of hearing and utterance of intelligent sounds—we might have voice, but no word could we utter; we might have anxious listeners, but no sound could ever reach their ears; we should, in fact, be in precisely the distressing condition of the deaf and dumb. The atmosphere also administers to the comfort of man, and the whole animal creation, in another very important manner, viz., it diffuses solar light and modifies its intensity, therefore rendering it both salubrious and delightful. Indeed, without an atmosphere so admirably constructed as ours is, the solar rays would only illuminate those objects on which they fell directly, or in a straight line; and if such were the case, we should have an intense blinding glare of light by day, and an intense darkness by night. But the atmosphere is so admirably constructed, that it diffuses the rays of the sun all round; every object on which the rays fall reflects them; and as the atmosphere is spread over every part of the earth's surface, so it produces both the reflected and mitigated light of the sun's rays, in its most agreeable form. The atmosphere, wonderful envelope of our globe! administers still further to the comfort and convenience of the animal and vegetable kingdoms, for it is the region in which the minute particles of water are drawn up by the sun's rays and the absorbing winds, and are there held in solution, or in the state of invisible vapour, until, by an electric process, it is converted into clouds, or visible vapours. These clouds not only soften the brilliant glare of light, but they produce comforting shade, and finally, by

renewed currents of electricity being passed through them, most probably being induced by the rays of light reflected from the planetary orbs, still further condensing the vaporous clouds, till they deposit their watery contents in refreshing and fertilising showers. The atmosphere has still another property of infinite value to the meteorologist, as well as comfort and convenience to all. I refer to its great effects on the temperature of our globe. It not only retains warmth in itself, but it diffuses heat around. That warmth may proceed from any or all of the following sources: First, the direct rays of the solar beams. Second, the latent heat within the crust of the earth, which is brought into action by the solar rays; or Thirdly, from light reflected from the planetary and cometary bodies.

I think it behoves every rational being to reflect, in what a doleful condition the surface of our globe would be, had we none of these sources of light; for we have only now to look on those great elevations on our globe, which reach an altitude of four or five miles, in which situation they have one-half the atmosphere below them, or that portion of the atmosphere in which all the phenomena, above alluded to, take place, and we shall find that all those elevations, even in the torrid regions of the globe (some of which exceed fourteen thousand feet), to be covered with perpetual snow. Eternal winter, indeed, pervades the lofty summits of the Andes, the pinnacles of the Alps—

"Where Alps on Alps arise,"

and the lofty turrets of the Himmalayahs. In these inhospitable regions—

"No mark of vegetable life is seen,
No bird to bird repeats his tuneful call."

No. XII.

THE ATMOSPHERE.—*Continued.*

Having thus briefly shown what the atmosphere is as a whole, and pointed out some of its uses, we shall perhaps form a more correct opinion of it, before defining its component parts, if we consider what would have been the condition of both the animal and vegetable kingdoms, had this earth not have been provided and attenuated, as we find it, as represented in the summit of the mountains above-named, or at an elevation of five miles, or about one-tenth of its whole height, we should very soon discover, to our great astonishment and discomfiture, that the waters of our lakes, rivers, seas, and even the ocean itself, would become solid masses of ice, from the absence of that heat which the lowest portion of our atmosphere contains. Vegetation would soon cease to exist, notwithstanding the light and genial warmth of the solar rays; the grateful changes of the seasons, or those beautiful and cheering transitions from winter to spring—from spring to summer, and from summer to sober and fruitful autumn, as we now find them in all their beauty and flowing abundance, would not be recognised. Nay, the whole earth would soon become a dreary and barren waste in an impenetrable shell of eternal ice, in which neither life nor motion, nor even beauty could exist! We see, therefore, how necessary is the atmosphere to the very existence of both the animal and vegetable worlds, which at the same time, we must bear in mind, that this atmosphere does not appear to be necessary or even essential to any of the grand functions of the earth, in the economy of the solar system; for we can readily conceive that our earth, as one of the confraternity of the planetary orbs, would be as it is now.

Hence, we must unavoidably come to this conclusion, that the Almighty formed this ærial envelope around our globe for the well-being, the comfort, and the happiness, of its occupants, as regards light, warmth, sound, and numerous other manifestations of his wisdom, in order to render this earth the joyous abode for every thing that has life and growth. It is indeed that blessed abode of man in which "he lives and moves and has his being." Let us now apply a similar course of reasoning to the other large globes of our system, and we shall discover that the Almighty, in His infinite wisdom and beneficence, has made them all to be the abodes of His own intelligent occupants:

> "He, the great Lord, the sovereign judge,
> That sits enthroned above,
> Wisely commands the world He made,
> In justice and in love."

Having taken a brief sketch of the rises of the atmosphere, it will be important, in a meteorological point of view, to notice the three following sources of light, as being of the utmost importance in judging of the weather in advance. First, that of the sun, or, more probably, his very luminous atmosphere, by direct emanation. Secondly, that of the planetary and cometary bodies by reflection. Thirdly, the resolution of fixed or latent light into radient light by combustion, or, as some term it, decomposition by electric or galvanic action.

As to the physical cause by which light is emitted by the sun, I think it is very probable man is destined to be for ever ignorant—at least on this side of the grave; for it is one of the sacred things of God, if we believe in the Mosaic accounts of the creation of light, which contains one of the most sublime sentences ever uttered by the lips of God. "And God said, Let there be light, and light was." What a

humiliating expression is this to the loftiness of man's vanity? Again, "Who can, by searching, find out God to perfection?" and yet it is wisdom in man to find out as much as his finite mind can comprehend.

Newton, by the introduction of the triangular prism, divided a ray of solar light into seven distinct prismatic coloured rays. Dr. Wollaston, knowing Newton's course of experiments, reduced the number of rays to four; but Sir David Brewster, one of the most indefatigable philosophers of the present time, has reduced the original homogeneous coloured rays to three primary colours, viz.:—red, yellow, and blue; and, therefore, the remaining four colours are only the results of combination; thus, if the yellow combines with the red, it acquires the various tints of light orange, dark orange, and scarlet, till it finally terminates in the distinct red ray. When blue combines with yellow, it forms light green, deep green, and very pale green, till it finally terminates in yellow; while, in the opposite prism, the blue becomes deeper—intense purple gradually softening down into violet. These combinations clearly prove the want of homogeneousness in all the rays, except the three primaries —red, yellow, and blue.

No. XIII.

THE ATMOSPHERE.—*Continued.*

Kyan, on the elements of light, and their identity with those of matter, radiant and fixed, says, "The elementary constituents of light are found to be composed of three gases—oxygen, nitrogen, and hydrogen," and we have just shown that the prismatic rays are red, yellow, and blue; hence, we have, by combination, on Kyan's theory, the red ray, oxygen; the yellow ray, nitrogen; the blue ray, hydrogen.

My old and highly esteemed friend, the late J. H. Abraham, Esq., of Sheffield, proved, while trying some electrical experiments on lateral discharges, on a jar overflowing with positive electricity, that he obtained sparks seven inches in length of a beautiful vivid rose-coloured tint, while I have seen negative sparks of a beautiful light-green tint. Hence, from these and similar experiments, the following facts have been deduced:—First, that oxygen (the red ray), positive electricity and positive galvanic power, with inflammation or combustion, are identical. Secondly, that nitrogen and hydrogen (the yellow and the blue rays), negative electricity and galvanic negative essence are also identical. Seeing then that the red ray of light, whether direct from the sun, or reflected from a planet, and positive electricity, are identical; and also, that nitrogen and hydrogen (the blue and the yellow rays), whether direct or reflected, and negative electricity, are also identical, I think the following hypothesis will greatly assist the astro-meteorologist in seeing how reflected light may act upon the atmosphere — the gaseous envelope of our globe. Suppose, for example, the sun and its luminated atmosphere are in a negative state of electricity towards our earth, and the other planets of our system, and that the hemispheres of both our earth and the planets always immediately opposite to the sun are in a positive state of electricity, they will of course be attracted by the sun. To illustrate this hypothesis still more clearly, let us take our earth, which we find, by its turning on its axis, always in the act of changing its surface in direct opposition to the sun, that the electric hemisphere in the state of positive electricity, still holds its position, consequently, that portion of the earth's surface which was positive during the day becomes negative during the night; therefore, a continued series of electric currents pervades the surface of our earth, and penetrates it to a certain depth, producing all those

compositions and decompositions, actions and reactions, from one state of electricity to another, all of which are highly essential in perfecting the operations of nature.

Taking these facts into consideration, I think we may justly infer that the whole surface of one hemisphere of our earth—that, in fact, which is exposed to the negative electric power, or the sun's magnetic force—cannot in every part of it be absolutely in a positive electrical state, but that it is in different localities, constantly varying, in consequence of the capricious condition of the atmosphere, which may be justly termed subservient to existing and local circumstances; still, by uninterrupted observations through a series of years, we find that the general average of the electrical condition is what the chemists term *plus*, or in sufficient excess to secure, under all circumstances, the mutual magnetic influence exercised by the sun and the earth towards each other. The same powers, as, I think, is highly probable, govern the electrical conditions of every other planet of our system.

There are, nevertheless, many local circumstances to be taken into consideration relative to the electric currents that pervade our atmosphere; for example, when the liberation of negative electric currents, or, more properly speaking, currents of negative electricity, take place on the earth, or on the ocean, and the positive electricity of the upper strata of the air, are floating freely about, like the negative currents below, it finds a refuge into which it silently creeps, like water forcing itself into a spunge, or as Dr. Lardner expresses it—"The cloud takes the nature of one continued conductor, and the free electricity accumulates on its surface, in the same manner as it does on the conductor of an electrical machine." Hence, then, negative clouds become the vehicles to convey the negative electricity thus contracted through the otherwise opposing air, towards the object of its attraction. It must, however, be borne in mind by every

student in this sublime study, which increases in sublimity at every step, that during the process of concentration of the two electricities the negative below, and the positive above, they begin to exercise their mutual influence—their own inherent natures—their great property of amalgamation—their mutual tendency to unite—having at the same time increased in their dimensions, and thus being brought into close contact. The positive clouds begin to unite together, and the lower (the negative) in proportion to their increasing size, and consequently increased electrical charge; their movements being facilitated by the negative electric currents below, as well as by the surface of the earth itself; and if that power of concentration and enlargement be mountainous in its character, very dense thunder clouds will hover about their summits, the electricity seeking its passage into the bosom of the earth by some ready conductor.

No. XIV.

THE ATMOSPHERE.—*Continued.*

At sea, both ships and islands act as electric conductors. Thus, says Humboldt, in his "Cosmos"—"Whereupon the whole, when the ocean of the air rests upon a fluid bottom, the electric balance is more rarely disturbed than is the air on land; it is more striking to see how, in extensive seas, small groups of islands influence the state of the atmosphere, and cause the formation of thunderstorms." We shall again refer to this subject, in speaking of the earth when its atmosphere is under particular influences from foreign objects, whether planetary or cometary, in order more fully to demonstrate their effects.

Having endeavoured to show that the transition of the

earth from one electrical condition to another is continuous, we may perhaps still further illustrate the subject by the following process:—Let our atmosphere, for example, absorb one constituent, suppose oxygen, the *red* ray of light, the compensation of the *blue* ray (hydrogen) and the yellow ray (nitrogen) are set free, and are at liberty as *negative electricity*. On the other hand, when the hydrogen (blue ray) and the nitrogen (yellow ray) are absorbed and chemically combined with constituent portions of our atmosphere, the oxygen (red ray) is liberated to act the part of positive electricity; hence it will readily be perceived, that perpetual absorbtion and chemical combination produce these changes of opposite electricities that are constantly pervading the earth and the whole of its surrounding atmosphere. Now, we know from multiplied observations that when the surface of the earth has an excess of positive electricity, or what the electricians call *plus-positive*, and that the superincumbent atmosphere has a deficiency of electricity, or is in that condition called *plus-negative*, an electric discharge will take place with just as much certainty as the electrician draws his sparks, when he brings the positive and negative pole of his battery into contact, or completes what he calls his galvanic circuit; but this mode of discharge will be upwards, or what is termed an ascending stroke, but such discharges make merely a loud crash, there is no open, or regular cloud peal. In general, however, the discharges of the atmospheric battery, if we may use the expression, are in the direction of the earth's surface, implying that the atmosphere is replete with positive electricity, while the earth is in a negative condition. But notwithstanding the general surface of the illuminated hemisphere of the earth, when the sun is visible to us, for instance, it is then in a positive state of electricity, yet in certain localities, and under peculiar circumstances of the accidental chemical combinations, which

are equally required to perform the grand operations of nature, an inverted state of the electrical influences, as regards the surface of the earth, and the atmosphere respectively, may, and very frequently do exist, and this forms one of the greatest difficulties, and at the same time one of the most interesting problems in astro-meteorological researches; still, even under these circumstances, the direction of the electrical discharge is mostly towards the earth, yet with a somewhat modified intensity. I have, indeed, in two or three instances, seen, what is termed an upward discharge, at the same time; but this generally happens when a small electric cloud, highly charged with positive electricity, passes over a portion of the earth's surface, which is in a plus-negative state; then there is generally an upward rush of the lower or negative current to meet the upward descending positive current, as if each were in great haste to restore the eagerly sought equilibrium; in such cases, the two currents have met midway between the earth and the cloud—a report, or rather a loud crash, has taken place where the two currents met, and all has been instantly over. In none of these occasions have I witnessed any downfall.

One more particular must be noticed ere we can pass on to the other planets of our system, and that is *direct* and *reflected light*, and their importance in astro-meteorology. This peculiar object of physical astronomy, is to show certain important results from light reflected direct from the sun,—the great giver of this sublime phenomena, and the same solar light reflected to our globe from each of the primary planets of our system. Its velocity forms an important item in astro-meteorological calculations. Its velocity is computed at one hundred and ninety-two thousand miles in one second of time.

We must also take into consideration the impetus which that light receives on its parting from the luminous body

on its important mission to the other bodies of our system.

Now, I think no rational being can doubt, for a moment, that the passage of even so imponderable a body as light through portions of space, of such vast dimensions, then penetrating an atmosphere of a great diversity of densities, from the necessary force of projection required for its complete accomplishment in one second of time, would impress any rational mind with the idea that it must produce at the point of incidence, or contact, an impression more sensible than we are in the general habit of recognizing. In illustration of this fact, we find that reflected lights, from the planet Mercury in $3\frac{1}{2}$ minutes with the impetus of one hundred and ten thousand miles in an hour; surely, then, this must produce a very visible effect upon so delicate a substance as our atmosphere, which can be turned aside by the wing of the most tiny insect; how much more, then, must a ray of light darting into it with such an immense velocity disturb the quietude of this vast ærial envelope of our globe. These phenomena, trifling as they may appear, at a first glance, are of very great importance to notice in the study of astro-meteorology and planetary influence.

No. XV.

GRAVITATION AND LIGHT.

The immortal Newton, from the broad features of celestial motion, traced his ideas up to the law of universal gravitation; whence he then justly concluded, and which has, since his time been fully verified. He considered that gravitation not only affected all matter, but rendered every part of the universe, that is, of our solar system, subject to the influence

of every other part of it; and hence, he was fully aware of the modifications which generalization induced into the results of partial and limited application to the same general laws, as affecting both the primary and the secondary planets. Newton, from the agency of the attractive powers of sun, and of the motion of the moon, was fully aware also, that perturbation existed among the planets themselves, independently of either solar or lunar agency; and although he did not fully carry out his investigations of them, but confined them to the attractive power of the sun over the moon, yet he so clearly paved the pathway leading directly to the temple of scientific truth, that that at which he only glanced, his talented and persevering followers have most satisfactorily accomplished. It is also a very gratifying circumstance, that there is not a single perturbation among the planets and their satellites, of an astronomical nature, that has not been satisfactorily traced to its origin in the mutual gravitation of the parts of our system, as parts of one whole. Such perturbations have been not only satisfactorily ascertained, but they have been reduced to numerical value, upon mathematical principles.

Before the time of Newton, the space between the planets was considered to be vacuum, but the master mind of that eminent astronomer, at the close of his valuable work, the "Principia," suggested the idea of a plenum; that is, he considered there was an ethereal medium pervading all the spaces between the planets, to which he consigned the novel idea of its being a something of an ærial, or, it may be, an electrical character, that was about seven hundred times more rare, or lighter, than atmospheric air.

From the time of Newton down to Laplace, philosophers in general have concurred in maintaining the idea, that such a highly attenuated, almost an inappreciable substance, was diffused throughout the range of the celestial regions;

although they were unable to offer any conclusive evidence in support of such an opinion.

The time, however, appears to have arrived, from the unremitting industry and undaunted research of master minds, when we are given to understand, that the entire of our solar system is but one connected series of heavenly bodies, all obeying the same laws, and, consequently, each acting in concert with the rest. Indeed, we feel this conviction, that the laws which regulate climate are as fixed and unremitting as any law in physical astronomy, and which are, in a great measure, dependent on them; therefore, every change of weather is the effect of some determinate cause, which, as is my firm conviction, will, despite both scepticism and prejudicial blindness, in due time be clearly discovered, or as correctly ascertained as the return of a comet, the recurrence of an eclipse of the sun or moon, or the occultation of one or more of the satellites of Jupiter.

Meteorology is, therefore, not only dependent, in my opinion, on planetary influence, but of the highest importance to every cultivator of the soil, whether on a large or small scale, that he may know, from the principles of astro-meteorology, when and what changes of the weather are likely to occur, when to sow his seed, and to reap his crops, &c.; or, that the fruits of the earth may be gathered in without exposure to foul weather. To the physician also this knowledge is very valuable, as by this science he may know, from the electrical conditions of the atmosphere, not only its proper times, but the proper kinds of medicine to administer to his patients, so as the sooner to restore them to health; to the botanist, that he may know when to take his botanical rambles in search of new and rare plants, without interception of bad weather; to the traveller, that he may know the best time to commence his journey without interruption from atmospheric impediments; to the navi-

gator, that he may know when to leave the harbour in safety from an impending and, probably, overwhelming hurricane. Indeed, such knowledge is exceedingly useful to every class of the community, as spread over the surface of the whole earth (for every country has its vicissitudes of weather), as it enables them to guard against the approach of any evil influences, which we know from observation and experience are continually in operation.

This vast field of research called Meteorology is not only of vast extent but of very great importance, as it is not restricted to the atmosphere alone and to the earth for its local and periodical influences, for the planets, too, have their several astounding effects, when they come into certain angular positions, or aspects, as stated in No. VII. of this series of papers, with each other and with the earth. Such, indeed, is their attractive power on each other, that astronomers are under the necessity of accounting for these astronomically. Surely, then, if these wandering bodies disturb or retard the entire masses of each other as they pass those given points of conjunction, square, sextile, &c., a similar effect, both reason and common sense seem to assert, must be reciprocal upon each other's atmospheres, for no one doubts but that each planet, and even the moon, is furnished with an atmosphere, with just such a composition as is suitable to whatsoever beings, rational or irrational, may inhabit them. But whether these disturbing forces are occasioned by electrical or magnetic forces, or by chemical action, or a combination of the whole of these forces, and probably other qualities or forces combined, which have not yet been detected, remains at present a problem for future master minds to solve.

No. XVI.

THE PLANET MARS ♂.

In larger circuit rolls the orb of Mars,
Guiltless of stern debate, and wasteful wars,
As some have erring taught; he journeys on,
Impelled and nourished by the attractive sun;
Like us, his seasons and his days he owes,
To the vast bounty which from Phœbus flows.

As the atmosphere of our globe is the recipient of the influences from every other planet composing our solar system, we will now advert very briefly to each planet in its order, and endeavour to show their several influences.

Mars is the first of the superior or rather exterior planets. We shall find that both the motions and aspects of the exterior planets differ very considerably from the interior, which never appear more than forty-six to forty-eight degrees either east or west from the sun; whereas the exterior planets appear at all distances from the sun, even to the opposition, or 180 degrees. Another marked difference is, the interior planets, when viewed through telescopes, exhibit all the phases of our moon; but the exterior planets never appear either in the crescent form, (except Mars, and that very slightly, owing to its nearness to the earth), or like a half moon, but they always exhibit to us their full enlightened hemispheres. Mars is usually represented by the symbol ♂, which is said to be rudely formed from a man holding a spear protruded, representing the god of war, which is the title of Mars in the heathen mythology. Mars may be easily distinguished from any other planet or star, by the red colour of its light. Mars revolves, at the distance of nearly 145* millions of miles from the sun, in about two

* Greatest and least distances from the sun, 152,670,000 and 126,620,000 miles.

of our years. When this planet is in opposition to the sun, his distance will be 240 millions of miles from the earth. But when he is in conjunction with the sun and earth, he is then only 50 millions of miles from the earth; hence, his influence when in conjunction is considerably more powerful than when he is in opposition, as will be shown by examples when we speak of him as a meteorological agent. Mars is also very different both in magnitude and splendour when he is nearest to the earth, to the appearance he presents to our view when in opposition; in the former position he appears twenty-five times larger than in the latter. The orbit of Mars is upwards of 900 millions of miles, over which he travels in 687 of our days, with a velocity of nearly 55,000 miles per hour, and revolves on its axis, like our earth, in twenty-four hours thirty-nine minutes of our time, from east to west. The diameter of Mars is 4200 miles, which is little more than half the diameter of our earth, so that when he approaches towards his opposition or greatest distance from earth, he then appears to dwindle down to the size of a small star; hence, as before stated, when Mars is nearest the earth he appears to be twenty-five times larger than when at his greatest distance; therefore, this planet is very seldom noticed, except during a period of about four months in every two years. The time between one opposition of Mars and another is two years and fifty days We get the best telescopic views of Mars when he is nearest the earth, viz., at his conjunction. After obtaining one series of views of Mars in this position, we must wait two years before we can again repeat our observations. The surface of Mars contains upwards of fifty millions of square miles, and his solid contents more than 38,000 millions of cubic miles.

The light that Mars receives from the sun is much less than that of the earth, especially at his greatest distance, the proportion being forty-three, that of the earth, 100; hence,

the solar light that Mars receives is less than one-half that the earth receives. Mars, however, is furnished with a magnificent atmosphere, such, that stars, when Mars approaches near to them, suffer a great diminution of light. Cassini, in his observations on Mars, says, "On a star in the constellation Aquarius, at the distance of six minutes from the disc of Mars, became so faint from its occultation that it could not be seen by the naked eye, nor even with a three feet telescope." We may therefore infer that the atmosphere of Mars is of great altitude and density; a fine focus for condensing and transmitting solar light to the other planetary bodies. It may probably be owing to very great density of the atmosphere of Mars that that planet appears to the spectators on the earth of a dark reddish hue; and probably it may have the same view to the inhabitants of Jupiter, and the still more distant planets; for we know, by numerous experiments, that when a ray of light passes through a dense medium, its colour inclines to redness, the other rays being probably absorbed. Thus, we often see the morning and evening clouds are generally tinged with red; also, the sun and moon, when near the horizon, either at rising or setting, frequently assume a reddish aspect, from the rays of light having to pass through our atmosphere horizontally, the lower portion of which is denser than that of greater altitude. Hence,

"The sanguine Mars displays
A strong reflection of primeval rays.

The light and heat of Mars are only about *two-fifths* of that enjoyed by the earth, but this is only on the supposition that the atmosphere and masses of the planets are very similar to the constitution of our own.

MARS AS A METEOROLOGICAL AGENT.

From daily observations, it appears that the influence felt in our atmosphere is owing to the nature of reflected light:

and as Mars reflects only the red ray of light into our atmosphere, we find, from numerous electrical experiments, that the red ray of light is equivalent to positive electricity, and that positive electricity is equivalent to *heat;* hence, the influence exerted by the reflected light from Mars should be heat, and this seems to be fully manifest, from a chemical action that seems to take place when the red rays of Mars are reflected into our atmosphere, and heat is evolved, and consequently the temperature of our atmosphere, is increased. This fact is more powerfully manifested when Mars is in single aspect; therefore, in judging of the power of the aspect, we must carefully note the increase of heat that takes place under mitigated circumstances; then mark the results when Mars is in aspect with a cold or negative planet, as Saturn or Herschel, for then his heating powers will be diminished in proportion to the antagonistic power in action.

As a proof that Mars does raise the temperature of our atmosphere, I will refer to his aspects in the year 1861. In this year Mars made thirty-one aspects, and I find that there was an increase of temperature on thirty of them (allowing four days for the completion of each aspect), amounting to 129 degrees. The temperature fell only on one occasion, and that only one degree, so that there was an increase of heat, amounting on an average to $4\frac{1}{3}$ degrees on each aspect, while the fall of temperature was 1 to 128, evidently bearing out the law that Mars, at all seasons of the year, and at nearly all aspects, increases our temperature. The fall of 1 degree occurred October 29, when Saturn had only just passed his conjunction with Jupiter, so that his cold and refrigerating influence was greatly subdued, owing to the heating properties of Jupiter.

The next paper will treat of the planet Jupiter.

No. XVII.

THE ASTEROIDS AND JUPITER 4.

The great interval which exists between the orbits of Mars and Jupiter led our earlier astronomers to surmise that there might possibly exist another planet of very considerable magnitude. This would seem to be a natural conclusion when we consider that the space between Mercury and Venus is 31 millions of miles—between Venus and the earth 27 millions—between the earth and Mars 50 millions; but between Mars and Jupiter there is an immense space of 349 millions of miles. Hence, then, the proportion of solar distances seemed to be interrupted; and hence, the old astronomers considered this increased space would form an exception to the general law of planetary arrangement. But these astronomers—

> "Were eager still in Nature's book to pry,
> And did the astronomic tube apply,
> And trace, with careful eye, the wide inane,
> The comet's blaze, and planetary train:
> Thus they did mark the various systems roll,
> And learnt the laws that regulate the whole."

Hence, Mr. Piazze, astronomer at Palermo, in Sicily, discovered the first Asteroid, Ceres, January 1, 1801.

Pallas was discovered at Bremen, in Lower Saxony, by Dr. Olbers, March 26, 1802.

Juno was discovered by Mr. Harding, at Lilienthal, near Bremen, September 1, 1804.

Vesta was discovered by Dr. Olbers, of Bremen, March 29, 1807.

These four were supposed to be all that revolved in that large space. Dr. Olbers, however, suggested that romantic

idea that obtained a full belief in the minds of many persons, viz., that the new planets, or Asteroids, from their small size, might be fragments of a planet which had been burst asunder by some internal convulsion. But modern astronomers have discovered numerous other Asteroids revolving between Mars and Jupiter, and have therefore swelled their number to 78. But as the whole of these bodies can only be seen with a very good telescope, they are necessarily omitted in the calculations of Astro-Meteorology.

This brings us to the noble planet

JUPITER ♃.

"Beyond the sphere of Mars, in distant skies,
Revolves the mighty magnitude of Jove,
With kingly state, the rival of the sun.
About him, round four planetary moons.
On earth, with wonder, all night long behold,
Moon above moon, his fair attendants dance."

Jupiter is the largest planet of our system, at the mean distance of 490 millions of miles from the sun. It includes within its orbit all the planets that have yet been described, within its mighty circumference of 3110 millions of miles, around which it travels in 11 years 315 days.

Jupiter revolves on his axis in 9 hours and nearly 57 minutes, hence his day is only about 5 hours long. His diameter is 89,000 miles, hence his circumference is 287,600 miles.

"Thus Jove, prodigious planet of the skies!"

The equatorial portions of Jupiter move round the axis of the planet with a velocity of 28,000 miles an hour, which is 3000 miles an hour more than our globe moves on its axis. The surface of Jupiter contains 24,884 millions of square

miles; and hence, his magnitude is nearly fourteen hundred times that of our earth. His rate of motion in his orbit is about 30,000 miles an hour, carrying along with him a splendid atmosphere, and four moons larger than ours, to adorn his nocturnal firmament; and hence, display a scene of grandeur, wisdom, and omnipotence, worthy of the infinite goodness and perfection of its Creator. We can also see another trait of wisdom in creative intelligence in placing the inclination of Jupiter's axis within little more than three degrees from the perpendicular; and, therefore, there can only be a very slight variation in his seasons; indeed, one might almost term his years a perpetual summer, in which, day by day—

"The smiles of morning gild the ponderous globe."

Had Jupiter's axis been inclined as much as that of our earth, his polar regions would have remained alternately in darkness for six years without intermission.

The intensity of solar light on the planet Jupiter is only one twenty-seventh of that of the earth; and hence, the mean apparent diameter of the sun, as seen from Jupiter, is only one-fifth of the size as seen from the earth; but if the intensity of solar light in Jupiter be increased by reflection, by any substances connected with this noble planet, or if the inhabitants have the pupils of their eyes enlarged in proportion to the diminution of solar light, all objects around them may appear even with greater splendour than those do in our earth.

Astronomers have not determined with this planet, as they have done with Mars, that it has an atmosphere of any great extent, yet it may be furnished with an appendage which ministers comfort and happiness to the inhabitants of so august a world, equally as our atmosphere does to the

inhabitants of this, our earth; and hence, admitting Jupiter to be a habitable world, and to be clothed with vegetation, after the manner of our earth, ideas which the mind of every rational being cannot fail to entertain, what beauties can we not fancy may adorn so magnificent a globe, enjoying an almost perpetual summer—plants, from the "hyssop on the wall," to others that may far outstrip the cedars of Lebanon in size and grandeur—fruits, whose sweetness may surpass even our ideal nature—and what must be the nature and characteristic of the inhabitants of this noble planet, in majesty and dignity, who are created to dwell in so magnificent an abode?

> "O thou great invisible, I feel and know
> That thou art everywhere,
> And worms and worlds—the lofty and the low—
> All, all thy power declare."

The celestial scenery from Jupiter must be sublimely grand.

No. XVIII.

JUPITER ♃.—*Continued.*

THE EARTH'S METEOROLOGY UNDER THE INFLUENCE OF THE RAYS OF THE NOBLE PLANET JUPITER.

As Jupiter reflects to the atmosphere of our earth a combination of the red and the yellow rays of light (oxygen and nitrogen), we find the orange-coloured ray producing, like the red ray, heat; and hence, with Jupiter's aspects, we may safely contemplate increased temperature, fine serene weather, excepting when he is contending with antagonistic influences; then we may look for violent thunder-storms in

summer—strong winds, mild air, and very large rocky clouds in spring—large wool-pack clouds in summer and autumn, and mild air, for the season, in winter; but if Jupiter's aspects be combined with those of Saturn or Herschel, in the winter we may have severe frosts. In verification of these facts, we will glance at Jupiter's aspects in the wet year, 1861. Out of twenty-five aspects, solar, lunar, and mutual, the temperature rose in twenty-three of them 115 degrees, and fell on only two aspects 7 degrees, leaving 115—7=108 degrees in favour of Jupiter's calorific properties, making about 4½ degrees rise on the average of his aspects. Rain fell on only five of Jupiter's twenty-five aspects, amounting altogether to three-tenths of an inch during the year, showing that Jupiter is of itself a heat-making as well as a dry planet. When, therefore, agriculturists see that Jupiter is about to form an aspect, either with the sun, moon, or Mars, he may calculate on fine dry weather for any operations he may have in hand, or would wish to commence. The pleasure-taker may arrange for his pic-nic parties without the fear of being drenched with torrents of rain, except when Jupiter is in aspect with Venus or Saturn, or is passing from an aspect of Mars to one of Venus, Saturn, Herschel, or even the far-distant Neptune, then he may not be surprised if he be suddenly overtaken by a thunder-storm, because opposite currents of electricity will be excited in the earth's atmosphere, on the earth's passing from one angle with Jupiter to a similar angle with Saturn, which may be termed a transition period; so that when the opposite poles of such a celestial battery are brought into contact, either by the lunar rays or some counter current of electricity produced in the upper strata of the atmosphere, which communicating its influence to the lower strata of the clouds, then a storm of considerable magnitude will very probably be the result.

Jupiter's solar aspects, when not connected with any other aspect, are generally attended by tremendous rocky cumulus clouds, highly charged with positive electricity. In the gigantic cumuli being carried off by induction, a grand display of thunder and lightning, with dashing rain, frequently takes place, and sometimes hail, if two or three negative clouds come up, with the aspect of so many *negative* planets, like the reinforcement in an engagement; then the scene is grand in the extreme, and of sufficient violence to strike terror into the stoutest hearts, and to make them quail with fear.

We cannot leave this stupendous orb without our minds being drawn to contemplate Him whose "understanding is infinite," and the depth of whose intelligence is "past finding out;" yet we see the causes which produce the effects which we have been contemplating to be but few and simple, while the phenomena are numerous and striking. It appears to me that, while the ends to be accomplished by this celestial machinery are both numerous and various, the means are the fewest that could possibly be used to bring the design into effect. What a striking contrast there exists between the modern knowledge of astronomy and the bungling and ponderous schemes of the ancients, who, with all their cycles, epicycles, concentric and excentric circles, their deferents, and solid crystalline spheres, could never account for the motions of the planetary orbs, nor explain any of their astounding phenomena! Oh, how unlike and simple are the works of our all-wise Creator, to the circumscribed and complex schemes of man! These few notions about the influences of the planets show us how it is that "the earth is full of the goodness of the Lord."

Having shown in this paper the effects ascribed to Jupiter when in solar, lunar, and mutual aspect, for the year 1861, we will now introduce the following table for 1863, showing

only Jupiter's solar aspects, in order to offer a fair test of his influence when not associated with other planets.*

S. *represents the Sun,* J. *Jupiter, and the figures the degrees distant.*

Days, 1863.	Aspects.	Mean Temperature.		Rain in Inches.	Weather.
		Rose.	Fell.		
Jan. 16,.....	S. ☌ J.	...	1	18	Rain, gale.
Feb. 16,.....	S. 120 J.	2	...	...	Fine and frosty.
Mar. 2,.....	S 135 J.	6	...	...	Fine.
Mar. 11,.....	S. 144 J.	1	...	...	Overcast.
April 12,.....	S. ☌ J.	...	2	...	Fine.
May 16,.....	S. 144 J.	2	...	·06	Showery.
May 25,.....	S. 135 J.	1	...	...	Fine.
June 8,.....	S. 120 J.	2	...	·20	Showery.
July 1,.....	S. 90 J.	2	...	...	Fine.
Aug. 14,.....	S. 45 J.	...	2	...	Cloudy.
Sept. 3,.....	S. 45 J.	...	5	·37	Rainy.
Sept. 24,.....	S. 30 J.	2	...	·13	Showery.
Oct. 31,.....	S. ☍ J.	...	4	·57	Gale and rain.
Dec. 8,.....	S. 30 J.	...	7	...	Cloudy.
TOTALS,...	14	18	21 18	1·51	
			3		

* The writer appears to have lost sight of the potent influence of the cold-producing planet, Saturn, being in operation on January 16, September 3, and December 8, which, according to Astro-Meteorology, should have very considerably modified the warmth of Jupiter, or what is more likely, have entirely over-ruled them. The sequel proved that there was no exception to the rule in either case, and as Mr. White's table also shows. On the first-named date, for example, Saturn was stationary, which not only set aside Jupiter's warm influence, but produced a gloomy, cheerless day, the chief features of which were strong wind, in retrograde movement, and an entirely overcast sky, which latter induced people to suppose that a fall of snow was imminent. The barometer, too, which on the previous day had obtained a maximum of 30·12, now commenced a rapid descent; being alike, the silent reporter of violent storms occurring at that time in America, and the precursor of violent storms in Eng-

We learn from this table that, when Jupiter is acting alone with the sun, he is not that hot and airy planet astro-meteorologists ascribe as his specific influences, for cold preponderates over the heat; it is true only in a small quantity, but enough to show that we cannot always calculate upon fine weather even under his solar aspect; for out of 14 aspects rain fell on 6 of them, amounting to an inch and a-half, which takes off the character of Jupiter as a dry planet; therefore, I think one caution is necessary before we give a specific character to any planet, because the aspects are not only very numerous, but are so constantly varying, that in one month or year a planet may have the character of a hot and dry planet, and in another, that of a cold and wet one.

No. XIX.

SATURN ♄.

"But further yet the tardy Saturn lags,
And light attendant luminaries drags,
Investing with a double ring his pace,
He circles through immensity of space."

There is not, in my opinion, any planet belonging to our

land. Again, on the 3rd of September, Jupiter's weak "aspect" with the sun was overpowered by Saturn on the equator, which resulted in cold, rough, and rainy weather. The third instance was on December 8, when again the weak aspect of Jupiter withstood the conflict of Saturn, the sun being also, at the same time, in aspect with the refrigerating planet. Hence, the day was frosty, foggy, and variable at St. Leonard's; stormy in Ireland; rainy at many places, and snowy at Scarborough. All these results were in accordance with *Zadkiel's* predictions; and if we remove from Mr. White's "temperature fell" column, the 1, 5, and 7 degrees of cold, fairly due to Saturn's influence, we shall find that, instead of 3 degrees *plus* cold as the results of Jupiter's fourteen aspects, there should appear, at least, 10 degrees *plus* heat as the said result.—*St. Leonard's Gazette.*

system that presents so magnificent an appearance in a good telescope as Saturn. The splendour of his rings and the number of his satellites present to the eye of the astronomer the most beautiful and astounding phenomena.

This magnificent orb is a little more than 900 millions of miles from the sun, being nearly double the distance of the benign Jupiter.

When Saturn is in its perihelion, or nearest distance from the sun, he is then 812 millions of miles, and revolves round our central orb in 29½ years; this is his sidereal revolution, or the time he takes to move from one fixed star to the same star again. Thus, he moves at the rate of twenty-two thousand miles every hour. The period of his diurnal rotation was for a long time only a matter of conjecture. The honour of this discovery is due to the late Sir William Herschel, who found it to be performed in ten hours, sixteen minutes, and nineteen seconds. Sir John Herschel does not make the time of rotation exactly like that of his father, but states it to be ten hours, twenty-nine minutes, seventeen seconds. This discrepancy of twelve minutes cannot affect any of our astro-meteorological calculations.

The circumference of Saturn is calculated to be 248,000 miles, and hence, he is nearly a thousand times greater than our earth. By his rotation on his axis, his inhabitants (if any) are carried at the rate of nearly 25,000 miles per hour, and his year consists of 25,160 revolutions, or days and nights, during which times he moves onward in space at the rate of 22,000 miles every hour.

As Saturn is nearly 9½ times farther from the sun than the earth, he will receive only about one-nineteenth part as much light as we do; but contemplating the power and wisdom of creative majesty, there cannot, there ought not, to remain a doubt in our mind, but that the beings who are destined to people this far-distant orb have their organs of

vision so wisely constructed, and so perfectly adapted to the quantity of light they have to receive, as that all the objects around them may appear as splendidly illuminated, and their colours as vivid, as those on our globe do to us.

The diameter of Saturn is 79,000 miles, and the surface of the planet, therefore, contains 19,600 millions of square miles. The density of Saturn, compared with that of the earth, is as one to nine; hence, the density of Saturn, compared with water, is less than one-half; therefore, bulk for bulk, Saturn's density is very little more than that of cork.

Many conjectures might be raised, and many speculative notions advanced, as to why this far-distant orb should be so light; but I think we cannot do better than leave that as the very point of wisdom in the mind of the Creator, for it is very probable that no other conditions that we are aware of, would better carry out his eternal plan. We feel, however, that a grand characteristic of creative wisdom is variety of plan, completeness of purpose, and the just accommodation of means to an end; so that, very probably, only a few simple and general laws regulate not only planetary motion but planetary influence.

In a very popular, and a very widely-circulated journal,* some would-be-thought-very-clever astronomer, writing on the orbs of heaven, stated, when speaking of planetary arrangement, that "while on Mercury, a native of the earth would scarcely be able to drag one foot after the other, from the strong attractive power pulling him to the ground, he could, on Saturn, leap sixty feet high as easily as he could here a yard." I do not see how these speculative notions can assist the student in Astro-Meteorology, and, therefore, shall not pursue them further.

The rings of Saturn, or rather the double ring, (some

* *Chambers's Journal.*

astronomers say triple ring) is one of the most astounding phenomena which has yet been discovered in the heavens. The old poet of nature, Brown, says—

"Muse! raise thy voice, mysterious truth to sing,
How o'er the copious orb a lucid ring,
Opaque and broad, is seen its arch to spread,
Round the big globe at stated periods led;
Perhaps (its use unknown) with gathered heat,
To aid the regions of that gilded seat,
The want of nearer Phœbus to supply,
And warm with reflex heavens his summer sky;
Else might the high-placed world, exposed to frost,
Ice waste, in one eternal winter lost."

Galileo was the first astronomer to get a glimpse of Saturn's rings, soon after he had invented his tube or telescope; but from the imperfection of his instrument he could not give a lucid description of it.

This magnificent appendage of Saturn is about thirty thousand miles distant from the body of the planet. It maintains the same position with respect to the planet, is incessantly moving round it, and is carried along with the planet in its orbital revolution.

The area of the surface of these rings is said to be 146 times the number of square miles on the earth's surface, and more than 588 times the area of all the habitable portions of the earth. If, therefore, we could suppose these rings to be inhabited by rational beings (and I see no reason why they should not), they would accommodate at the rate of population before stated, more than eight billions, or ten thousand times the population of our globe.

Physical laws must be considered to operate in the system of Saturn, as well as in our earth and moon, and the other planets; and hence, we have another proof of the consummate wisdom of the Almighty contriver, in so accurately adjusting

everything with respect to this planet, his rings and his moons, as to preserve them in undeviating stability.

We might enter into endless speculation as to the use of Saturn's rings, &c., but to very little purpose.

My next paper will treat on Saturn as a meteorological agent.

No. XX.

SATURN ♄.—*Continued.*

An old philosopher—probably Lilly—says that "Saturn produces cold and dryness, for he is very remote from the sun's heat, and from the earth's vapours. But he is *more* effective in the production of cold than dryness." In order to test this character of Saturn, as given by ancient philosophers, we will take Saturn's solar aspects for the year 1863, and show the rise and fall of mean temperature on the day before and the day after the aspect—that is, of three days; and also the rain-falls.

From this table, we learn that the temperature rose on nine aspects, and fell on eight, showing that the reduction of temperature was only three degrees, and therefore we cannot call Saturn a cold planet; neither can we call him a wet planet, as rain fell only on six out of seventeen aspects, and the amount of rain with Saturn's solar aspects being only 0·81 of an inch. But I have noticed previous years when the falls of temperature have greatly exceeded the risings, showing a considerable degree of cold, and also an excess of rain; but then it must be understood that in the cases here referred to, all the mutual aspects were taken into the account, and therefore both the excess of cold and rain may possibly be due to other planets with which he was in con-

figuration, and not to himself alone; and hence, I think, we may fairly call Saturn a warm and dry planet, as so little excess of cold is manifested under his solar aspect, apart from the aspects of other planets.

TABLE—*Showing whether Saturn is a cold and dry planet, or a cold, wet planet, as modern philosophers state, from the solar aspects during the year* 1863.

Days. 1863.	Aspects.	Mean Temp'ture.		Rain. in Inches.	Weather.
		Fell.	Rose.		
Jan. 25	☉△♄	9	...	·05	Cloudy and gale.
Feb. 9	135°	13	...	...	Clear and frosty.
Feb. 17	144	...	3	·10	Fog m., fine a.
Feb. 23	150	...	6	...	Frosty, fine.
Mar. 23	☌	...	7	...	Generally Cloudy.
April 26	144	2	...	...	Brilliant.
May 5	135	7	...	...	Very fine.
May 20	△	...	7	...	Cloudy, Damp.
June 20	□	...	3	...	Fine.
July 24	☍	...	2	·11	Fine, showers.
Aug. 10	45	3	...	...	Fine.
Aug. 28	30	2	...	·30	Thunderstorm.
Oct. 2	☍	...	8	·05	Damp.
Nov. 5	30	14	...	·20	Cloudy, light rain.
Nov. 13	36	...	10	...	Frosty, fine.
Nov. 22	45	...	5	...	Brilliant.
Dec. 21	72	4	...	...	Cloudy, Damp.
TOTALS,...	17	54 51	51	·81	
Excess of cold,		3°			

"Notwithstanding the anxiety of our respected correspondent to arrive at correct conclusions—and we know how great and painstaking that is—we are disposed to believe that he has unintentionally fallen into the error of ascribing to Saturn's influence some instances of warmth and dryness which more properly belong to the heat-giving planets, Jupiter and Mars. We have already ventured to show, that in consequence of an oversight in three instances of Saturn's potency for cold, Mr. White's table of Jupiter's aspects gave to the latter planet the credit of producing

three degrees of cold, instead of, as we conceived it, ten degrees of heat. In giving isolated instances of planetary influence, there is sometimes the danger of mistaking the effects of a compound aspect for that of a single cause, or of overlooking altogether the influences of an opposite character; and this we think Mr. White has unwittingly done in the compilation of the above table, as well as in the one which preceded it. Mr. White, like ourselves, has hitherto been of opinion that Jupiter and Mars are warm, dry planets, and Saturn and Uranus are cold, wet planets; nor can we yet see that our esteemed friend has made out a case for a contrary belief. If we look into cause and effect, as suggested by the foregoing table, we shall there find materials for a different conclusion to that which Mr. White has arrived at. Passing over the first date (Jan. 25), which appears from the tabulated statement to have been rainy, windy, and nine degrees more cold (in harmony with the reputed influence of Saturn), we come to the next date, February 9, when the fall of the temperature was even greater, viz., 13 degrees. The weather, however, was fine and frosty. This cold is, of course, accounted for by the solar aspect of Saturn; and if we remember that the moon was in conjunction with Jupiter on the same day, and that Jupiter was within two days of his stationary position—a two-fold influence for fine weather, we need not wonder that the 9th day was fine as well as cold. Then, take the 17th of February, when Saturn was again in solar aspect, and bearing in mind that the 3 degrees *rise* is reduced from the three days, 16th, 17th, 18th, and that the first and last of those days witnessed warmth-producing aspects of Jupiter and Mars, we no longer wonder that the two heats against one cold result in a slight rise of temperature. The next date in the table is February 23, described as "frosty and fine," with 6 degrees rise of temperature. This rise (the mean of three days) is again easily accounted for, seeing that the warm influence of Venus, Jupiter, and Mars, were exerted on the first and last days. The weather, however, in this locality at least, was not fine on the 23rd, but was overcast and threatening all the morning, and cold and rainy in the afternoon—a very different day, in fact, to the 25th, which was beautifully fine and mild, under the parallel declination of Sol and Jupiter. The next date is the 23rd of March, when the solar opposition of Saturn was surrounded by the calorific influences of Venus and Jupiter, Mercury and Mars, and Mercury and Jupiter; and hence, the 7 degrees rise is once more clearly accounted for. Then, on May 5, when the table shows 7 degrees *fall*

of temperature, there was a mutual configuration of Mercury and Saturn, as well as the solar aspects, while Venus also conjoined Uranus; these, as against the one aspect of Venus and Jupiter, thus reduced the temperature, as was anticipated. But, on the 20th of the same month, when the solar orb was angulated with the cold body of Saturn and the warm body of Mars at the same time, and the double aspect was preceded by two warm aspects of Jupiter, the table was turned, and a *rise* of 7 degrees was the result. Of August 10th and 28th it need not only be said that Saturn's solar aspect unopposed by Jupiter resulted in reduced temperature, as predicted, and that a single aspect of Saturn, when opposed by one of Jupiter and Uranus, produced a thunder-storm, also as predicted. The beginning of October was not only remarkable for an 8 degrees rise of mean temperature, but for an English earthquake as well, the same having been predicted as the likely result of the uncommon occurrence of the sun in conjunction with Saturn and Mars, and the planet Uranus stationary at the same time. Then, as a last comparison, take the 5th and 13th of November, the former of which is shown in the table as subjected to 14 degrees *minus* the average heat, and the latter to 10 degrees *plus*. The cold period had the unmitigated influence of Saturn, whilst the warm period had the one aspect of Saturn surrounded with a host of opposite influences. Enough, therefore, has been shown in these few appended remarks, to prove that the tabulated statement of our respected correspondent is but an imperfect criterion, and that the effects of planetary influence must be judged of in their respective bearings on each other. To us it appears that Mr. White has not yet obtained sufficient data to warrant his relinquishment of the theory which he, in common with others, has hitherto held."—*St. Leonard's Gazette.*

No. XXI.

NEPTUNE ♆.

Brave Adams, in his mind's discerning eye,
Sees a new planet in the distant sky;
Finds its true place, midway between the poles,
There Neptune's mighty orb majestic rolls.

The keen vision of the old astronomers detected the principal wandering bodies that compose our solar system.

No less the keen eye of modern astronomers has added many new planets to the number of those discovered by the ancient astronomers.

The bold genius of the renowned Kepler led the way to planetary investigation, by predicting that the time would come when a planet would be discovered between the orbits of Mars and Jupiter. That time has arrived, but, instead of one planet occupying the vacant space, no less than eighty small bodies, which astronomers have named planetoids, in preference to asteroids, not only completely fulfilling Kepler's forecast, but holding out ample encouragement to modern astronomers to continue their researches in the heavens.

About the year 1780, a tolerably accurate knowledge of planetary perturbations, had been acquired by diligent study and careful research. But so great were the perturbations or irregularities in the motion of the planet Saturn, that Sir William Herschel conceived they might be caused by a comet, or another more remote planet of our system; accordingly very diligent observations were made, and, on the 13th of March, 1781, Sir William noticed in the field of his telescope a small star, apparently of the eighth magnitude. Its remarkable appearance attracted his attention, so that he applied a greater magnifying power, when this strange star showed unequivocal symptoms of being either a comet or a planetary body. The following evening the star was found to have changed its position, and in a few more evenings the newly discovered body was pronounced to be a wandering star or a planetary orb. Its motion was found to be progressive, like the other planets of the system, and its orbit was consequently very soon ascertained. Its mean distance was computed at 1828 millions of miles from the sun, and its year was determined to be equal to 84 of our years. Its diameter to be about 35,000 miles; its circumference 110,000

miles; and its magnitude to be about eighty times larger than our earth.

After Sir William Herschel had made the discovery of Uranus, as the new planet was finally called, and after a very lengthened discussion among the astronomers, geometers commenced their labours very earnestly to ascertain its orbit with accuracy. They were also enabled to trace its place backward for an entire century previous to the date of its discovery. This computation was done to ascertain whether its place had ever been observed by any astronomer, who had ranked it among the fixed stars; so accurately were all their calculations made, that they ascertained it had been observed no less than nineteen times by four different observers.

About forty years after this planet had been discovered by Sir William Herschel, the prince of astronomers in his day, M. Bouvard, of the Academy of Sciences, Paris, a very distinguished astronomer, commenced an early investigation of the movements of Uranus, and computed a set of tables with great accuracy. He was, however, soon met by difficulties which were almost insurmountable. In this stage of his calculations he was obliged to reject the observations as being less reliable than the new ones. In this state, M. Bouvard left the problem for posterity to solve.

After M. Bouvard had left the problem of the perturbations of Uranus for posterity to work out, it gave rise to many conjectures. Some thought that the attraction of the Sun did not prevail beyond the orbit of Saturn; others, that the irregularities were owing to some large invisible satellite attendant on Uranus. Others affirmed that the force of a comet had deflected the planet from the earth. But not one of these opinions gained confidence among astronomers. Dr. Hussey, in 1834, stated to Professor Airy his opinion that there might be some disturbing body beyond Uranus.

In 1842, Bessel suggested to Sir John Herschel that the deviation of the planet Uranus might be due to the action of an unknown planet, in which suggestion Sir John Herschel agreed. It was, however, left for an Englishman to solve Bouvard's problem, although, owing to an improper delay of Professor Airy, he did not obtain the honour of being the acknowledged discoverer.

Mr. J. C. Adams, Fellow and Assistant of St. John's College, Cambridge, sent to Professor Challis, of the Cambridge Observatory, values which he had obtained for the heliocentric longitude of the disturbing body, the longitude of its perihelion, and mass of an assumed planet exterior to Uranus. About the end of October, 1845, the following very important results were forwarded to the Observatory, Greenwich, viz.:—

Mean distance (assumed by Bode's law), . . .	3°-8·4
Mean sidereal motion in a year, ...	1°-30·9
Mean longitude, 1st October, 1845, ...	323·34
Longitude of its perihelion, ...	315·55
Eccentricity of its orbit, ...	0·1610
Mass, that of the Sun being unity, ...	0·0001656

These were, undoubtedly, the first data of the planet that were made public, and had Professor Airy attended to them immediately, Mr. Adams would have enjoyed the entire honour of being the first discoverer of this new primary planet, an honour which would have placed Mr. Adams in the first rank as an astronomer.

It was not, however, till eight months after Mr. Adams had submitted the elements of the supposed new planet's orbit, viz., June 1, 1846, to Professor Airy, that M. Le Verrier gave in the *Comptes Renous*—a memoir of the new planet. No elements, however, were given either of the orbit or mass of the planet; but its longitude, it was stated, at the beginning of 1847 would be about 326 degrees. Le

Verrier communicated his conclusions to Mr. Galle, at the Berlin Observatory, and that astronomer found the planet on the same evening as the communication arrived. Had, therefore, Professor Airy forwarded Mr. Adam's calculations to Berlin even after he had received them, the undivided honour of the discovery would have been given to an Englishman.

The planet appears like a star of the eighth magnitude, and may, therefore, be seen with a very moderate degree of magnifying power; but it will be difficult to an unexperienced eye to distinguish it from other stars in its vicinity without a very high power being used, under which circumstances its disc may be very clearly perceived.

Its distance from the sun is computed at 2862 millions of miles. Its apparent disc subtends an angle of a little more than three seconds, so that its diameter will measure 50,000 miles, which determines its bulk to be 250 times that of the earth.

Here, then, we have a planet which has been hid from the ken of man, in the very depths of space, for thousands of years, yet performing its revolutions with the greatest exactness, which it accomplishes once in 164½ years.

Whatever honour may be due to M. Le Verrier—and it is certainly very great—yet Mr. Adams led the way in computing the elements of the orbit of Neptune from actual observation—and he was soon followed by other astronomers, and its elements were fully determined.

As a meteorological agent, but little as yet has been fully ascertained, and therefore many more observations are necessary, before his real influence can be positively affirmed, especially as he remains nearly fourteen years in one sign of the zodiac, one can know nothing as to his influence at one season of the year compared with that of another. As, however, he is now and has been for a long time close to the

equator, his solar aspects have chiefly been of a cold stormy character, but not of very long duration, as the earth soon gets out of the field of his influence. It will be worth while for meteorologists to notice, more particularly the kind of weather attending his aspects, as I am persuaded, notwithstanding his great distance from us, that he has an influence of a meteorological character, sufficiently to testify that solar influence extends to that far distant planet.

No. XXII.

COMETS.

"And what art thou, portentous stream of fire,
That followest close the pathway of the sun?
Com'st thou in mercy to us, or in ire?
And, is thy course now finished, or begun?

The nature, physical constitution, and effects produced on our globe, during the approach, presence, and departure of comets, have given rise to various theories, and to a greater number of conjectures and hypotheses than all the other celestial bodies belonging to our solar system.

It is not to be wondered at, that their sudden appearance in any and in every part of the heavenly vault—their extraordinary aspect, and their rapid motions—excited terror in the minds of the ignorant, while they awakened curiosity in the learned.

In the days of Homer, when they began to be noticed with careful attention, they were considered as the harbingers of divine vengeance; and hence, Homer writes:—

"The red comet by Saturn sent,
To fright the nations by a dire potent,
A fatal sign to armies on the plain,
Or trembling sailors on the watery main."

The superstitious regarded the comet which appeared forty-four years before the Christian era as a celestial chariot, conveying the soul of the assassinated Cæsar to the skies.

One class of mankind viewed comets as vehicles, designed by the Creator to convey the spirits of their departed friends under the superintendence of their guardian angels, to the realms of paradise.

Another class looked upon comets as the active agents of natural and moral evil upon the surface of the earth.

Of this opinion were Milton, Dryden, Young, and other poets of nature. Milton compared the indignation of Satan, at being opposed in his passage by Death, to a burning comet; and hence, he sang:—

> "The fires at length of Opheneus huge,
> In the arctic sky, and from his horrid hair
> Shakes pestilence and war."

An Italian astronomer, or rather empiric, describes comets as messengers "that dealt in destinies, dark councils, and sage opinions of the moon—that knew men's planets, and their good angels and their bad;" and hence, he predicted, from comets and "the spots on the sun, that the world would be destroyed on the 18th of July, 1816." So much for man's foolish predictions of such an event, which is one of the secret things of God, and which is wisely hidden from man's curiosity.

Pythagoras and Aristotle taught that comets were only meteors, which were not only produced in the earth's atmosphere, but they perished in it; and, therefore, they classed them among the realities of nature, and appointed them definite paths among the celestial bodies. Seneca boldly opposed these opinions; for, "I cannot believe," he says, "that a comet is a fire suddenly kindled, but that it ought to be ranked among the eternal works of nature; it has its

proper place, and is not easily thence removed; it goes its course, and is not extinguished, but runs off from us." In our time we shall understand more fully their physical influences over the gases of our atmosphere, and their important functions of the universe. Tycho Brahe gave it as his opinion that comets "were permanent, solid bodies, moving in orbits similar to those of the planets; hence, our poet Young, describes the great comet that appeared in 1577, as—

> "The comet that doubles wide
> Heaven's mighty cape, and then revisits earth
> From the long travel of a thousand years."

The elements of more than one hundred are now known, and more than five thousand are said to visit our system. Sir Isaac Newton, Dr. Halley, Sir John Herschel, and other able astronomers, have concluded that comets revolve round the sun in every eccentric ellipsis, and return again to the sun after certain periods. Our knowledge of comets, however, is but very limited, and, indeed, cometary philosophy is but yet in its infancy. The generally received opinion is, that comets are solid bodies, though less dense than planetary bodies;* that they gravitate towards the sun, and that,

* "Comets are heavenly bodies attached to planetary systems after, it would appear, the planets of the system had arrived at a solid state, most of them probably at their ultimate condition of maturity. . . . . Comets are incipient worlds, progressing slowly, according to our notions, to their ultimate, habitable condition—a condition which some philosophers think may have already begun in the case of a few of the most advanced of known comets. These gaseous bodies are younger by many thousand years than the planets of our system. As all globes were once in a gaseous state, comets furnish ocular demonstration that the nebulary theory is true, though they tell us nothing of the state or states in which matter exists, before it becomes visible in a gaseous form."—*From the Creative Week.*

while they are within our solar system, they obey the same laws as the planets. There can, however, exist no doubt, but that each comet has its appointed junction in creation's illimitable field to perform; for—

"Of Him thou tell'st who bade thee roam so far,
Through fields of space immeasurably hurl'd,
Beyond the circuit of each planet star,
Beyond the boundary of our solar world."

And hence, I have denominated comets to be (although I do not consider myself to be an authority), "the interlaces of solar systems, and the great equiponderates of nature."

Persons at all acquainted with the laws of planetary astronomy, know that the Almighty Creator adapts His works to the particular circumstances under which, if it is His pleasure, that should exist and act, for the comfort and happiness of His intelligent creatures, and *not* as represented in the following stanza—

"A pathless comet and a curse,
The menace of the universe;
Still rolling on with mighty force,
Without a sphere, without a course."

Although comets are said to obey the law of the solar system while they are within it, yet their courses are very different from those of the planets; for the latter are all direct, or from west to east, while the former move in various directions; that is, some are direct and others retrogade; and these in nearly equal numbers. Out of 137 whose elements have been fully determined, 68 had direct motion, and 69 retrograde, or from east to west, their velocities increasing as they approach the sun, and diminishing after they have passed their perihelia.

Planets move in their orbits in planes, which vary very

little from the earth's path; comets have almost every inclination, as the following table distinctly shows:—

INCLINATION.

9	Comets have from		...	...	...	0 to 10	degrees.
13	"	"	...	...	...	10 to 12	"
10	"	"	...	...	...	20 to 30	"
17	"	"	...	...	...	30 to 40	"
14	"	"	...	...	...	40 to 50	"
23	"	"	...	...	...	50 to 60	"
17	"	"	...	...	...	60 to 70	"
19	"	"	...	...	...	70 to 80	"
15	"	"	...	...	...	80 to 90	"

137 Comets.

Hence, no analogy exists between the orbits of planets and comets. With this very brief notice of comets in general, we will now try to get a glimpse at their physical constitution.

No. XXIII.

PHYSICAL CONSTITUTION OF COMETS.

"A theme so great, so noble, does require,
A Pope's pure diction and a Milton's fire."

I am not aware that any kingdom, either of ancient or modern times, ever attained to the proud elevation of intellectual pre-eminence which at the present time dignifies our noble and illustrious isle. Can there be a greater blessing conferred on the human mind than that of knowledge? It is by knowledge alone that one man elevates himself above his fellow-man, and above the sphere of the mere grovellers of the earth. It is by knowledge alone that man can read the book of nature, which fits him to read also the book of

revelation, with everlasting profit to his soul—the true end of all philosophy.

If we study the productions of a Guido or a Titian; if we read the sublime compositions of a Milton or a Shakespeare; if we follow the footsteps of a Kepler or a Newton, we shall be able to form in our own minds a tolerably correct judgment of the talents, the disposition, and the virtues of the artist, the poet, or the philosopher. Nay, do we not, by holding converse with the mighty dead, introduce ourselves to the company of beings of a superior order? If, then, we can obtain a knowledge of the disposition and natural endowments of man from his works—for, "by their works shall ye know them"—can we not, by a careful study of the varied and mighty works of Him who created the heavens and the earth, arrive at a considerable knowledge of the attributes and perfections of the great Creator Himself?—the love and fear of whom are the very beginning of wisdom. It is even a beginning of that wisdom which is the practical portion of all our acquired knowledge in every department of human study; for—

> "To study God, God's student, man, was made,
> To read Him in his nature's text conveyed;
> Not as in heaven, but as He did descend,
> To earth, His easier book; when to suspend
> And save His miracles, each little flower
> And lesser fly shows His familiar power."

But, with all our boasted acquirements in every department of scientific and literary pursuit, I fear we may yet exclaim—

> "How few, alas! in this degenerate age,
> Employ their noble faculties and powers
> In *scientific knowledge;* rich supplies;
> From thence we draw, nor will the fountain cease
> To flow, till time itself shall be no more."

The sciences, as they are studied in the present day, have, I fear, for their object the effects of causes only, leaving the causes themselves shrouded in utter mystery. At the same time, we are told that of all the sciences, astronomy is the one which has advanced the nearest towards perfection. It is true that the science of astronomy enables the skilful navigator to cross the trackless ocean with comparative safety, apart from the danger which arises from atmospheric disturbances. Astronomy also enables the merchant to open communications with the most distant portions of our globe, which would otherwise have been for ever separated from him as by an impassable barrier. It enables the missionary to convey across the pathless seas and deserts, "glad tidings of great joy," to the benighted heathen and the "untutored savage." And, by astronomy, it is equally true, we are enabled to point out the exact spot in the canopy above us which shall be occupied by any of the planetary bodies at any given moment, as well as the precise instant of a solar or lunar eclipse; and, on some occasions, at least, the return of a comet has been foretold with considerable accuracy. Yet, with all this knowledge, marvellous as the statement may appear, the very calculators of these exact phenomena are confessedly ignorant of those physical causes which produce the sublime effects thus computed; and hence, I fear

"My feeble lays
Degrade the subject I intend to praise."

But, to return to the subject of comets, it may be said that a comet is defined to be a luminous body which appears in the heavens only for a limited period, seldom exceeding a few months, during which it has a motion peculiar to itself, and by which its place among the fixed stars is rapidly changed. Its appearance is usually that of a collection of vapour, more or less defined in its shape and proportions.

Most comets have luminous trains, commonly called tails, and which are sometimes immensely extended. Professor Airy remarks,—"On the physical constitution of comets we have learnt nothing, except that they appear to be wholly gaseous." In confirmation of this idea, Sir John Herschel, speaking of the gaseous substance of comets, states that in 1832 he saw through the centre of Biela's comet a group of stars of the sixteenth magnitude; and yet, the appearance of this comet created almost as much alarm in England as did the dreadful ravages of the cholera which attended it. The alarm thus created was in consequence of some wild speculations relative to the comet encountering the earth in its progress, and the possibility of such an event involving us in one general ruin. One lady, from the suburbs of the metropolis, actually broke up her establishment, and with the proceeds of the sale went to South America, to avoid the dreadful calamity she anticipated. At this enlightened period we blush to think that such a degree of ignorance prevailed; but do not feel so much surprised at a similar alarm in France, in May, 1773, when Lalande very imprudently communicated to the Academy of Science the probability of disaster from the then approaching comet. There were not wanting in the Catholic metropolis of Paris, persons ready to turn the alarm so incautiously inspired to a profitable account, and in such manner that "many places in Paradise were sold at very high prices,"—

> "And then art came when all our fears were rife,
> And every heart was aching with unrest;
> For earth itself, as if instinct with life,
> Her awe-struck sons was shaking from her breast."

We come now to the inquiry, Have comets any effect upon the atmosphere of our earth? Goldsmith, in his *Citizen of the World*, says, "To a philosopher, no circumstance, however

trifling, is too minute; he finds instruction and entertainment in occurrences which are passed over by the rest of mankind as low, trite, and indifferent; it is from the number of these particulars, which to many appear insignificant, that he is at last enabled to form general conclusions."

We are now arrived at by far the most difficult part of our subject; and in order to do it justice, it will be necessary to premise a few general observations on cometary astronomy. This highly important and extremely interesting theme has occupied the pens of the master minds of all ages; and it requires, at the present period, nothing short of a giant energy to throw even a faint light upon the seeming mysteries of cometary influence. The foul weeds of superstition and prejudice are still deeply rooted, and that too often in soils where we should have thought mental culture and philosophic training would have prohibited their growing. But, thanks to science, there are minds engaged in the search after truth—and I trust not a few—which, in spite of existing prejudices, believe there are causes continually in operation, which are eminently calculated, under the guidance of the all-powerful Creator, and in strict harmony with His eternal wisdom. And one of those physical causes, I have reason to believe, from the mutations daily in operation around us, is attributable to cometary agency—

> "Lo, these are parts of Thy stupendous ways!
> In penetrating to the utmost depths
> Of space, I am compelled to exclaim,
> . . . . I cannot go
> Where universal love and smiles are void."

And hence, I think, we may venture to say of comets, as of stars, *Sapiens dominabitur astris.*

Design appears equally manifest in the motions of both

planets and comets, and is, perhaps, more particularly evident from the fact, that the centripetal and centrifugal forces so exactly balance each other upon that general law in physics which asserts, that all bodies attract each other in the direct ratio of their masses, and in the inverse ratio of the squares of their distances.

No. XXIV.

THE USES OF COMETS.

When we seriously contemplate—

> "World beyond world, in infinite extent,
> Profusely scatter'd o'er the blue immense."

we trace the mighty works of creative power and wisdom, and say with our poet, Thomson,—

> "His hand directed the revolving spheres,
> Turn'd in their orbs the comets, which, so grand,
> Brandished their golden tresses in the skies."

Having briefly noticed the nature and physical constitution of comets, a few remarks on their probable uses may render the subject more complete for the students of physical science.

> "Hast thou ne'er seen the comet's flaming light?"

When this question was asked three or four centuries ago, the person to whom such a question was addressed, no doubt, would have trembled with exceeding fear of the fatal consequences that were expected to follow, viz., "Terror to gazing nations." But, thanks to the truths of science, we

now hail their appearance with joy, and welcome, with hearty greeting, the return of that *blazing* comet, which

> "Doubles wide
> Heaven's mighty cape, and then revisits earth,
> From the long travel of a thousand years."

And, so soon as we become familiarised with their appearance, we contemplate their returns, as we do the planets, and ask, What is the use of comets? Astronomers tell us, that, with regard to the purposes for which they were created, "all is doubt, uncertainty, and conjecture." This may be a solemn truth; but since we have learned that nothing, how insignificant soever it may be, has not been created in vain, comets, like other heavenly bodies, must have their uses, in the stellar world.

One set of philosophers supposes, that they are "the means appointed by the Almighty, for putting a period to the planetary world." Others have imagined that comets, in their several revolutions, gradually approach the sun, till at last they fall into it, and thus become a supply, as it were, of fuel, to sustain the brilliancy of that glorious luminary! But Dr Maver, more outrageous still, states that some learned savans are of opinion that they are places of future punishment, or places of torment for lost souls, where they are to undergo for ever the eternal vicissitudes of the extremes of heat and cold in alternate succession,—in fact, that comets are the hades, or the places of torment.

Such minds certainly never reflected on the infinite goodness and omnipotent power of the Creator, who has formed creatures suited to all states and conditions of existence; has also created abodes in every way adapted for the comfort and happiness of intelligent existences, among which may be the cometary as well as the planetary worlds. For, wherever we can discover matter, we always find it either pregnant with life or subservient to that purpose. We have

then only to consider the numberless species, the astonishing diversity of animal existences that people the air, the earth, the water,—nay, every blade of grass, every tender leaf, every brilliant flower, every natural fluid, swarms with life; every individual of which enjoys every gratification its nature and constitution require.

Before the march of intellect had really commenced its onward progress of investigation and research, it was said that some portions of our earth were uninhabitable, viz., the torrid zone, in consequence of its great heat, and the friged zones on account of the perpetual and supposed unendurable cold; but science and discovery have set at naught these silly surmises, and proved the contrary to be the fact.

It has now become the general opinion, that the planetary bodies, from their being provided with atmospheres, and like our earth, performing diurnal and annual revolutions, are the abodes of intelligent created beings, who enjoy every comfort and happiness, and at the same time are capable of praising and adoring their Creator, clearly proving to intellectual minds their several uses. Intelligent minds, fraught with these sublime ideas of creative wisdom, would it be unjustice to our intellects, or derogatory to science, or want of belief in the power of the Creator, to suppose that such large masses of durable matter, as comets are,—how dissimilar soever they may be in their construction to our globe, or to any other planetary orb,—to conceive that they too were peopled with beings equally capable of contemplating with wonder, and acknowledging with gratitude, the wisdom, the power, and the goodness of God, notwithstanding their mighty tour through space, visiting system after system, than we are in our comparatively narrow circuit? Comets may have beings,—

> "With constitutions fitted for that spot
> Where Providence, all-wise, has fixed their lot."

How difficult soever it may be to our finite minds to discover the original and particular designation of comets, one fact remains patent to our minds, that in what position soever the Deity exerts His omnipotence, there He also equally manifests His infinite wisdom and goodness.

In watching the return of comets to our system, and on referring also to the records of some of the largest that have been seen, during a period of 1800 years nearly, *i.e.* since the great comet A.D. 79, we find that comets produce stormy weather on their approach to their parahelia, followed by a great increase of heat, often giving an unhealthy character to our atmosphere. It is said that the great comet of 1680, which required more than 3800 years to perform its mighty elliptic orbit, "gave out much light and heat;" and it has been estimated that "that comet underwent a heat 28,000 times greater than that of red-hot iron;" hence, the philosophers of that age considered the nature and composition of comets to differ widely from that of planets; still, all these facts lead us to consider that comets have their uses in the system of creation.

It has been affirmed by some physicists, that much cold is felt in our atmosphere on the departure of a comet from the sun, and from our system, and 1811 is given as a specimen of heat during that year, when the great comet was visible from July 1811 till February 1812. That summer exceeded in heat that of any other summer for many years; every species of fruit had its natural flavour, and the wine made from the vintage of that year, called the comet wine, sold a few years afterwards for £40 per pipe more than the wines of other years. This fine season was followed by the extremely severe winter, 1813 and 1814, when the Thames in England, and most of the continental rivers, were frozen over.

When we consider the exceeding velocity of comets at

their perihelia, or their nearest approach to the sun, and the comparatively slow progress they appear to make at their appelia points, we wonder how the attractive force of the sun can bring them back again to our system. Take for example the comet of 1680, mentioned above, which requires more than 3800 years to complete its elliptic orbit to return again to our view. We must conceive such a body to wander far beyond the attractive force of our sun than the last discovered planet, Neptune, which requires about 167 years to perform one revolution, so that its orbit cannot be less than 108,389,200 millions of miles, or more than 108 thousand billions of miles. But what is this to the distance a comet must travel in more than three thousand years?

Sir Wm. Herschel, however, has thrown much light on this subject, for he has told us that comets "may revolve round two suns," one in each focus of the mighty ellipse, or "may have a tortuous path," and revolve round several suns ere it returns again to the sun of our system. Without such a supposition as this, it would be quite impossible to form any rational opinion on so occult, yet so sublime—so interesting and so ennobling a study. Let us ask for what end these brilliant comets shine.

In order to obtain any rational idea of the real uses of comets, let us just glance at their astounding courses through the regions of illimitable space, and we shall not only learn the infinite greatness of the divine Creator, who "has stretched out the heavens as a curtain," and thus afforded to our finite minds ample scope for suggestive ideas.

In the first place, their mission, that is, those of long duration, which is to traverse space, and visit one solar system after another. Secondly, from the effects which they are observed to produce on our world as they pass through our system, they seem to give out or distribute something that it may require to renovate it,—to give it a

healthy tone, and increase its productiveness; but whether that something distributed be electric or magnetic, or some other property of matter yet unknown to man, is not yet ascertained by science. Still the idea is conceivable, and will, in due time, meet with a true solution, as all previous ideas have done.

Thirdly, it may also be appointed by the same Almighty power, that a comet, in passing through our system, may take up from our earth, and from every planet of the system, something that renders our planet, or another planet, not in a healthy condition, and therefore a renovation becomes necessary, which seems to be a rational mode of proceeding under divine governance, for the healthiness of our own system, as well as other systems.

Lastly, for the stability of the universe itself, it seems to be expedient that some special physical force should be in operation to perpetuate through all time the works of even the Creator himself; and hence, I think, from these various uses to which we may conceive comets to be applied, we may consider them as *the interlacers of solar systems*, and the *grand equiponderates of Nature*—

> All things the same eternal laws obey,
> When God's unerring finger points the way.

No. XXV.

SHOOTING STARS.

> "These seeming stars fall headlong from the skies,
> And, shooting through the darkness, gild the night
> With sweeping glories, and long trains of light."

These wonderful meteoric phenomena are but little understood as to their origin or usefulness, either in an astrono-

mical or meteorological point of view, and so they are likely to remain, until some practical results can be obtained from their periodic returns.

They are, however, not confined to particular seasons, or particular days, although they are much more frequent at one time than another. In warm calm nights in summer and autumn, and in clear frosty nights in winter and spring, they may be frequently seen studding the azure vault, as if the stars themselves were actually falling from their fixed positions, and hence their denomination shooting stars, or sometimes falling stars. They appear to be preci pitated towards the earth, as if they would fall down upon it; but they disappear, or become extinguished ere they reach it. I have witnessed many disappear very suddenly, others seem to break up into fragments and leave long luminous trains behind them; and such as these are particularly noticeable in clear frosty nights in winter and spring. They are, at such periods, generally of an unusually larger size, and their colour a very brilliant silvery blue, but some of their trains I observed had a tinge of red in them, as if very active combustion was going on, but I never could trace any residium that appeared probable had fallen to the earth.

The periods, however, when these shooting stars are to be seen in their greatest numbers, are about nights between the 10th and 11th of August, and the nights between the 13th and 14th of November. On the former of these occasions they have not so decided a focal point as the latter, the former arising from various points, and the latter principally from the constellation Leo—mysteries which at present are not resolved.

Their line of progress is generally inclined towards the earth. Some, however, appear to have an upward tendency; but that may possibly be an optical deception, when the meteor or shooting star is directly approaching the observer,

it may have the appearance of rising. Whether they are generated in the atmosphere or beyond, opinions vary; but it appears, on their passing through the atmosphere with great velocity, they become ignited, and are soon dissipated, which seems to infer they are of a very gaseous nature. This idea is more especially referable to the ordinary shooting stars, or such as compose the *meteoric shower*.

This hypothesis, I should think, would not be tenable with respect to luminous appearances of large size, which appear to have their course beyond the limit of our atmosphere; according to the opinion of some observers—such, for instance, as have been seen at the same time, at places, from 200 to 300 miles apart. One of these was first seen at Leeds, on the 18th of May, 1710. Its direction was from north to south. Its course was noticed through Yorkshire, Lancashire, Nottingham, Derbyshire, etc. Yet each observer saw it at the same time, and, though so many miles apart, it appeared to fall within a very short distance of each of them.

A similar one was seen in England, May 19, 1719. In London, at about 8 h. 15 min. P.M., a very powerful light suddenly appeared which completely eclipsed that of the moon, which was nine days old, and shining very brightly near the meridian, the sky being very clear and free from cloud at the time. It gave out a very powerful stream of light, and its size was said to be nearly that of a full moon. But its light was said to exceed that of the sun on a clear day.

It appeared to have moved in one minute over more than twenty degrees of the heavens, and to be about as much above the horizon. Its train was of a faint reddish yellow, like red-hot iron. It continued visible for about a minute. Its perpendicular altitude was estimated at 64 miles, and its velocity was computed at 300 miles per minute. It was not

only seen in Great Britain and Ireland, but in France, Spain, Holland, Germany, all nearly at the same time, and to all it presented nearly the same phases. The reports from Devonshire, Cornwall, and neighbouring counties state that it exploded with a very loud noise, resembling a volley of artillery discharged at a great distance, which was shortly afterwards followed by a rattling noise, like that of small fire-arms discharged singly. During the discharge the air seemed to be in a state of vibration or tremour, and the windows and doors were observed to rattle, as they would do during any great percussion in the air.

There is, however, another species of meteors, called aërolites by some philosophers, and bolites by others; but they appear to be of a totally different character to those termed shooting stars. They are generally seen at very great altitudes, and are observed to make a rumbling noise before they explode. After explosion many fragments fall to the earth, weighing from a few drams to many pounds, and some even tons. But all these meteoric stones smell very strongly of sulphur; many large masses of this sort have been noticed, but all of them have been in a state of fusion when they fell to the earth.

How these bodies really originate is not, I believe, yet fully known; some have supposed them to be fragments of planets, others to be ejections from the moon, to equal in apparent size the full moon; and yet a body to be ejected from the moon, so as to fall under the earth's influence, would require a force greater than that communicated to a cannon ball with twelve pounds of gunpowder.

Chemical philosophers suppose they are formed in the atmosphere, and that their great velocity is due to their specific gravity; which caused them to fall to the earth, and that they become ignited by the friction of the atmosphere with their increasing velocity, and which produces their explosion.

Those that have been found have always been in a condescent state. Many of them have been analysed, and have been found to contain 46 parts of silex; 38 of oxide of iron; 15 of magnesia; 2 of nikel; and 2 of lime.

These are all terrestrial substances; and hence the general conclusion is, that they are neither fragments of planets, nor ejections from the moon, but simply exhalations from the earth itself, which, by affinity, have adhered together till their own specific gravity overpowered the buoyant power of the air; and hence, from their rapid descent to the earth they became ignited, and hence they became visible as burning substances—while the shooting stars, in the ordinary use of the term, may be chiefly a combination of solidified gases, disturbed very possibly by some powerful electric or magnetic current, or probably both, and hence their ignition, their brilliant appearance, and countless numbers.

If it be asked of what utility to our earth are these various displays of meteors, whether they appear singly at distant intervals, or in the grand meteoric shower, is a question very difficult for man to answer.

It is evident, however, to every contemplative mind, that the Divine Being has some specific purpose to answer, by permitting these phenomena to appear, and especially when they assume periodicity; and, wherever that specific purpose may be, it will be found to be in complete harmony with His wisdom, power, goodness, and every other perfection of His Divine Nature, every right thinking and rational mind must admit without any hesitation whatever,—for we know that many of the prominent designs, or general ends, which the Creator intended to accomplish, may be traced in various departments of His works,—this few will dare to deny. That design may be fully inferred from its recognised effects, is a grand principle which master-minds generally recognise in their investigations of great operations, both of nature

and art; and hence, these grand meteoric displays may be an equalization of such gases, as if, accumulated to too large a magnitude, might bring destruction in their train, instead of producing, as it appears highly probable they do, a very benefical result upon the air we breathe, and render it more salutary for the inhabitants of our globe; or they may cause a distribution of inflammable gases, which, if suffered to accumulate, would poison the atmosphere, instead of purifying it. These and other purposes may have entered into the designs of creative wisdom, which we have yet been unable to discover or even to appreciate; and, as "the works of the Lord are great," so let us search them out, in order that we may more clearly perceive the manifold designs, and infinite goodness of creative majesty.

[The majority of the foregoing Essays were originally published in the *St. Leonard's Gazette*, the editor of which Journal took exception to some of the data given, and conclusions drawn therefrom, by Mr. White; but when the editor has made himself more fully acquainted with planetary philosophy, by means of careful *registration of facts*, he will, we venture to predict, find out what is already an established truth, that *no planet*, in its influence on our atmosphere, can be called strictly either *cold* or *hot*, but that *all* planets produce both elements when in *solar* aspect, and these aspects must be *orbital*, not Zadkelian, or imaginary angles.—"B."]

WEATHER PREDICTIONS.

Some kind but unknown friend has sent me your impression of February 13, directing my attention to your correspondent's letter, signed "F. R. A. S.," on the subject, "Weather Predictions." This subject is also my "hobby"—not, however, all my life, but for nearly thirty years, during which time my remarks on the weather have been published weekly in one or more of the London weekly papers, so that I have obtained the appellation of "Weather Prophet," whether deservedly or not time must determine.

From my position, therefore, before an inquiring and enlightened public, I venture to address a few lines to your journal, not to complain of the opinions of "F. R. A. S.," but to endeavour to show that I think the true philosophy of "weather predictions" is possible—not, perhaps, by any theory which is at present adopted.

I have tested the lunar theories of Lieutenant Saxby and Mr. Doxat, and I find them to be all "moonshine." I have tested the vernal equinoctial theory of Mr. Du Boulay, and find that not based on any rational principle at all. This gentleman, however, has for the last year or two challenged all England to find a person capable of predicting the weather of the coming summer before the 18th of March. I accepted his challenge last year, and his theory failed in the latter portion of the summer. I have accepted his challenge for the coming summer, and propose sending my predictions for the coming summer—which I anticipate will be a fine one—to the *Mark Lane Express*, which will appear on Monday, March 2, and to your journal also, if you will grant me permission to do so.

Your correspondent calls upon a Sir John Herschel, an Airy, or a Glashier, "to favour the public with their views on the question." That they will not do, but I will try to do so for them. The last-named gentleman told me at the "Royal Observatory" that he anticipated that by long-continued observations, and recording accurately all the meteorological, electrical, and magnetical instruments, he should be enabled to deduce the laws of meteoric action, and of electric and magnetic intensity. Time will show the fallacy of this method of trying to develop the causes of natural phenomena.

I have tried to find out a law from my observations, which have been recorded with a "severely careful" attention for more than a quarter of a century, but no law, no cycle, no return of phenomena can I find; but this I have found, that during the above period I have not found two corresponding months, or weeks, or scarcely days, exactly alike. All theories, cycles, and comparisons seemed to be alike unsatisfactory. At last I tried the theory of planetary influence, taking an astronomical basis for my foundation, and the solar system as the field of observation.

We are told by philosophers that every globe of our system influences every other globe, in proportion to its magnitude, &c., and also that the moon influences the waters of our globe very powerfully; if so, why could not the planets produce an influence also? for the same medium that conveys the lunar influence to our earth would also convey stellar influences.

Now, taking the earth as a planetary body, moving among the other planetary bodies of our system, sending forth her influence to them and receiving influence from each of them, the whole being under solar control, just as the movements of a watch are under the control of the main spring, it becomes interesting to watch the remarkable coincidences that

occur as the earth passes by the major planets, or is passed by the minor planets.

I believe it is the general opinion of astronomers that the planets are furnished with atmospheres, and every necessary element for the abode of myriads of inhabitants, and that they were intended by the Creator to subserve the same ultimate designs as the earth, and contain the same adaptation to the full enjoyment of sensitive and intellectual beings.

I will only give a very brief outline of the course I adopt in trying to predict the coming weather. I find that when the planet Mercury flies, as it were, past our earth, with a velocity of 110 thousand miles per hour, we notice moderate gales of wind to follow; and it is very rarely we are deceived, especially during his inferior conjunctions. With Venus, whose motion is slower, we find, from the soft beams of light she sheds upon us, generally a humid, warm atmosphere in the spring, summer, and autumnal months, but cold, rain, or snow in winter. As we pass the highly-electrical planet Mars, we find heat from his red ray generally follows, with fine dry weather for many days, and even weeks sometimes. As we pass by or near to the mighty Jupiter, which is 1480 times the size of our earth, and rides—

"With kingly pomp, the rival of the sun,"

we find, generally, fine weather at all seasons of the year. When we approach the far-off Saturn—a thousand times larger than our earth—we find his rays to be magnetical, always blue (while Mars and Jupiter are highly electrical), and therefore we find cold at all seasons of the year, generally accompanied with rain or snow in winter. Approaching Herschel or Uranus, we find similar results to those of Saturn—in spring, summer, and winter, dense wet fogs or small rain, with raw, cold air. With the planet Neptune we

generally meet with sudden squalls and hurricanes, or cyclones.

It must, however, be observed that, when the earth approaches two or more of these planets at the same time, the results are very much increased, and if two antagonistic planets, as Mars and Saturn, the former being electrical, the latter magnetical (as determined by their rays of light being red or blue), we generally find storms of thunder and lightning. When the earth comes in antagonism with Jupiter and Uranus at the same time similar convulsions are observed. This is an interesting subject for study, and produces numberless phenomena illustrative of planetary influence being the true source of weather changes.

The *Nautical Almanac* furnishes the places for every planet for every day in the year, so that the earth's path among them is easily distinguished.

If you, as editors, or "F.R.A.S.," or other correspondents would like examples showing the workings of the planetary theory, I shall be most happy to forward them to the columns of your daily issue.

If "F.R.A.S." will favour me with his address I will forward to him a pamphlet which will furnish him with much useful information on this sublime, interesting, and useful subject.

I do not think that Admiral Fitzroy's storm warnings come under the head of predictions.

MERCURIUS.

ADMIRAL FITZROY AND HIS SYSTEM OF FORECASTS.

No. I.

In treating of the meeting of winds, it is necessary that we should have a clear conception of the nature of those physical laws to which all the currents of the atmosphere are in subjection. Without, in some measure, having a knowledge of these, it is as vain to try to comprehend the motions of the air as it is to attempt to decipher any inscription without some knowledge of its alphabet. Espy has often assured us, and we begin to think he is not far wrong, that it is almost useless to argue with rotatory theorists, as they never approach the question and discuss it on its scientific merits. We know of no writer who has examined the great storms of extra-tropical latitudes and come to the conclusion that they are of a rotatory character, who has at all made himself master of the fundamental principles of the science which John Dalton discovered eighty years ago—*i.e.*, the nature and properties of the invisible vapour of water in the atmosphere—and the important principles which other philosophers have subsequently enunciated. If any one of our readers should think that this is merely some vain and groundless assertion, he has but to name his author, and we shall bring him up before Dalton, and try to substantiate the indictment.

Perhaps the chief cause of the rotatory theory having got such a hold in this country is owing to its advocates having

made *one man* a dictator on the question, instead of holding, as Bacon recommends we should do, the highest authorities as mere consuls. At a Cambridge meeting of the British Association, held now well on to thirty years ago, Espy's in-blowing theory of storms was first introduced to the notice of Englishmen; Sir John Herschel then and there set that theory down as something verging on the impossible, because he thought that the barometer *ought to rise in the centre of centripetal storms, instead of remaining low.* All the facts adduced were then thrown aside as "something worse than useless." Hence the cyclonic mania that has ever since prevailed, although, as was then pointed out, the principles which Dalton, the "father of meteorology," had discovered, enable us to understand why the barometer should remain lowest, as in the Royal Charter storm, at those places to which all the winds are tending. Though Sir John Herschel has made no open acknowledgment of his former error, he has done so in a general way in his article on meteorology in the *Encyclopædia Britannica.*

There is no doubt that Espy's original views were rendered less likely-looking by his leading us to suppose that the in-blowing winds of hurricanes and storms rose in a body or vortex in the centre of storms. But we called his attention some ten years ago to the grounds which led us to believe that the winds during storms, instead of rising in one place, rose gradually over every part of their course where the barometer continued to fall. This view, we are glad to say, has since been adopted by Espy in his *Fourth Report on Meteorology*, but not carried out in explaining certain of the phenomena. We have had more discussion with Espy on our minor points of difference than with all the rotatory theorists put together. We never had any pretensions to cope with him in his profound knowledge of the physics of the whole subject. He was an original discoverer, and

followed up in those paths where Dalton left off. But, in the explanation of many of the phenomena of storms and the weather, we have attempted to make the principles laid down by him and Dalton fit better into the actual facts. We shall adopt our own mode of explaining the phenomena of the Royal Charter storm without alluding to the particular views of Espy.

That winds may blow towards a low barometer, which notwithstanding a constant in-blowing may never rise, is seen at the equator. To that line, the northern trade-winds, on the one hand, and the southerly trades on the other, pour their vast bodies of air in a perennial current. These winds, from two opposite hemispheres, ascend not in a vortex, but over a space of about sixty miles in breadth. Where they do ascend into the upper regions of the atmosphere, and again flow towards the south and north poles, they precipitate a large portion of their moisture in heavy and almost continuous rains. The sailors know this rainy equatorial region as the "doldrums," where there is usually a great want of winds. Both Speke and Livingstone met in with this rainy belt in the interior of Africa. This rainy zone travels with the sun, and keeps under him whenever vertical in his course from one tropic to the other. The winds are also in-blowing during storms. They tend to that area where the barometer stands lowest; and where the barometer is low and falling, there is usually a copious fall of rain. The precipitation of moisture is the cause of the low barometer, and the low barometer is the cause of the winds being driven towards the diminished pressure. The winds try, as it were, to fill up the partial vacuum; but, owing to the *vapour of water* which they contain, they, as it were, always undo what they attempt to do—to restore the equilibrium of pressure. Just like the trade-winds that blow perpetually towards a low barometer, which is their place of meeting, but are

never able to restore an equal pressure of air within the tropics.

Rains, it ought to be remembered, are almost entirely produced by the ascent from the lower beds of the atmosphere of warm and moist air to its higher beds, where, coming under less pressure, it expands; and the *cold produced by expansion of the air* condenses the vapour of water in a similar manner to that of the cold jet of water condensing steam in the condenser of an engine. It was Dalton who put us in possession of all these secrets by one simple experiment. On suddenly expanding moist air at common pressures into twice the space it occupied, its moisture was at once condensed into a thick cloud or mist within the receiver. These facts are well known to all physicists. Espy, as already said, took up this subject where Dalton left off, and his experiments have not only added to our knowledge, but corrected some mistakes which crept in, and are still treated as genuine coin by the greater part of our men of science. As an instance of this, we give Herschel's explanation of the production of rain from the cold of expansion, in *Good Words*. We put the erroneous part of the statements in italics. "This (condensation of vapour) is a consequence *partly of its arrival in a colder region*, but *mainly* of the property which all gases and vapours alike possess, of absorbing and rendering latent a large quantity of heat as they expand in volume, and so becoming *ipso facto* colder. The vapour so chilled (by expansion) loses its vaporous state, and condenses in the manner stated above." That the vapour of water chills and condenses itself under expansion is an error which crept in Daniell's works, but there is no authority for it in Dalton's. Lardner, Regnault, and Espy, in treating of the properties of water, however, have shown that there are no grounds for supposing that the vapour of water is condensed by the absorption of its own heat through

expansion. A cubic foot of steam, for instance, at 212 degrees, and at 30 inches barometrical pressure, may expand without condensation till its pressure does not amount to the thousandth part of an inch of mercury, and its temperature from expansion becomes far below the zero of Fahrenheit. Indeed, if we do not rob it of any of its heat, we cannot fix any limits to its expansion and rarefaction in vacuo. It is the *cold of expansion* of the permanent gases of the air which precipitates or condenses the vapour into water. The cold arising from the rarefaction of *dense* gases is much greater than from *rarer*. It is this property which is the cause of rains being precipitated when moist air at the surface of the ground ascends into the higher regions. Moist air at the pressure of 5 inches of mercury, as Espy has shown, though expanded into double its bulk, does not throw down the moisture, as the cold of expansion of the air does not overtake the decreasing temperature of the dew-point. It is for this reason that we find no clouds in the higher beds of the air, where the barometer must sink to 5 inches of pressure. Were moist air to ascend from the surface of the earth to the top of the atmosphere, it would lose a large portion of its moisture till it arrived at those altitudes where the barometer stands at 5 inches, and then it would cease to be precipitated by a further elevation or expansion. It is the cold of expansion of the permanent gases of the atmosphere which is the primary cause of our rains.

It is common for Admiral Fitzroy and other writers to speak of the polar and equatorial currents meeting and mingling, and thus causing rains. But were it possible to mix at once the whole body of moist and warm air within the tropics with that in both hemispheres, there would be no great precipitation from this cause alone. This is the old theory of Hutton; but our hygrometrical tables show that there is little precipitation from mixing air saturated with

vapour at very different temperatures. *There is not a paragraph in Fitzroy's writings that exhibits the true principles upon which rains are produced.*

If Admiral Fitzroy wishes us to give a detailed criticism of Dové's views, as exhibited in the Board of Trade papers of 1858, edited by himself, we shall do so. We only say here, after having gone over them once more, that we can see little else in them than a series of inconsistent and unsupportable propositions. Our assent is asked to the universal existence of the law of gyration, while the "anomalies" or the exceptions to the law are sometimes found to be more numerous than the instances which are said to prove it. There are no "anomalies" in the laws of nature. Herschel and others, however, became so enamoured with the law of gyration that they have committed a blunder which for absurdity is unparalleled in the annals of science. We will just give an outline of the conclusions arrived at. When a railway train is running either due *north* or due *south*, it is pressed respectively against the *west* or *east* side of the rails, owing to the rotation of the earth. The rotation of the earth increases the friction of the wheels of the carriages upon the sides of the rails, and it becomes, like a brake, clearly a resisting or retarding force. It is the same with a due north or due south wind—the rotation of the earth acts as a resisting force to it also. Can Fitzroy yet point to a chapter in Dové's writings where the force which propels the wind is treated of? When Dr. Hare failed twenty years ago to discover "a cause for violent winds" in Dové's essay, Redfield answered him that this was not to be viewed as "a blemish or defect." But, a little further on, Redfield asserts that some of the "forces" to which storms owe their momentum had been shown by Dové to be as enduring as "the rotation of the planet;" in other words, the *rotation* of the earth was regarded by Dové and Redfield as

one of the forces which *propelled* winds, instead of being a resisting force. Is Admiral Fitzroy not aware that Herschel endorses this absurdity in the *Encyclopædia Britannica*, when asserting that hurricanes do not occur at the equator, owing to the winds there being less subjected to the deflective influences due to the rotation of the earth? A retarding force has thus been converted into a propelling force.

As to the force which propels the winds, Fitzroy, after Maury, seeks it in "electrical action." But we have no evidence that electricity is a moving power in storms. We know, however, that there are other forces brought into play during storms, in comparison to which, as Dr. Tyndall tells us in his enchanting work, *Heat Considered as a Force of Motion*, the force of gravity itself, far less that of the divergence of the winds from rotation of the earth, may be regarded as *zero*, or a vanishing point. Such a power is evoked when the vapour of water loses its elastic state, and sets free its latent caloric. "I have seen," says Tyndall, "snow flakes descending so softly as not to hurt the fragile spangles of which they are composed; yet to produce from aqueous vapour a quantity of that tender material which a child would carry demands an exertion of energy competent to gather up the shattered blocks of the largest stone-avalanche I have ever seen, and pitch them to twice the height from which they fell." When Espy drew the attention of meteorologists to such forces, Dové and others passed them by with marks of interjection as unworthy of further notice. All writers on this science should study Tyndall. Espy has laboriously shown how this power is applied in the propulsion of the winds. He says:—"You will find by calculation, that if 644,700 tons of coals, of 2000 lbs. each, were burned on an area of ten square miles in an hour," it would be only equivalent to the energy evolved by the condensation of "*one inch of rain*" in the same time over the

same surface. The energy of steam condensed at 32 degrees is far greater than that produced at 212 degrees, for the latent heat is not only greater at the low temperature, but the latent heat evolved by ice or snow has to be added. All great storms and hurricanes *are driven by steam.*

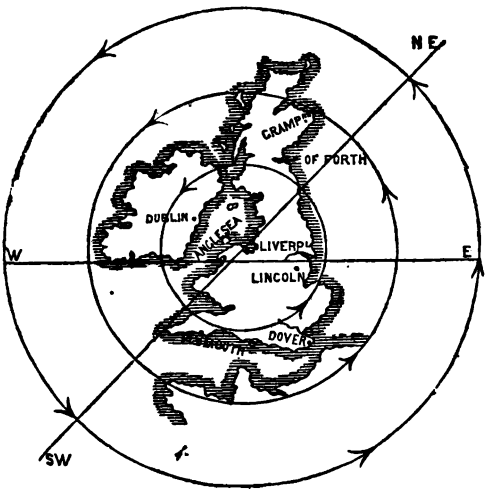
We have thus alluded to the principles upon which the production of rain and winds depend. These will enable any one to understand any few words that we may afterwards use which might otherwise be thought to be either technical or unmeaning. With the aid of a few diagrams and figures, we hope to be able to show how the facts of the Royal Charter storm fit and dovetail themselves into each other, in accordance with the laws which Dalton first made known to us. We shall do what we can to take the general reader along with us, without him finding any difficulty in following us.

No. II.

In justice to ourselves, we must show what is or was formerly meant by the whirlwind theory of storms.

When Mr. Milne Home and Sir William Reid applied the rotatory theory to explain the nature of storms and the veerings of the winds in Great Britain, no one had any difficulty in understanding so simple-looking an hypothesis. They fixed upon a point as a centre, and, taking compasses, they showed that all the winds during storms were, or ought to be, parts of vast whirlwinds moving over its surface. The whole British Islands were enclosed within its ample sweep, and every wind that blew was said to be a segment or tangent of the circling mass. We have drawn a small figure as a sample of those which Mr. Milne Home and Sir William Reid were wont to describe. We have put the centre, or lowest point of the barometer, a little to the south

of Liverpool; and no one can fail of having the clearest conception of the direction of the wind, in any quarter of the kingdom, or its surrounding seas, if these were actually portions or tangents of circles.



In those palmy days of the rotatory theory, there was no talking of cyclones or whirlwinds being curvilinear, or "half-circling or cyclonic;" or, who ever heard of Reid, Redfield, or Milne Home writing about the "meeting of the winds," which by them were condemned to perpetual gyrations? The rotatory theory, then, meant that winds moved in veritable circles. Cyclones were then believed to be actual whirlwinds, not half-circles. Even so late as 1861, Admiral Fitzroy tells us that in a wide and open ocean "all winds are cyclonic or circuitous, although their sweep is sometimes so large as to outreach ordinary ranges of observation, in which case, at any one place, they may seem to be 'straight-lined.'" Reid and Redfield, in like spirit, taught, that all our autumn and winter storms were usually whirlwinds of

1000 miles—sometimes 2000 miles—in diameter. There was no help for them, for if they attempted to explain the direction and veerings of the winds, on such an hypothesis, scarcely any limits could be fixed to its ample gyres. In one of the charts given by Dové in the third number of the Board of Trade papers (1858), the centre of a cyclone is fixed off the French coast at Brest, and its circles are made to embrace the heel of the boot of Italy on the east, the Ural Mountains and Lapland on the north. That this is also the common and popular notion of what is meant by cyclones may be gathered from a graphic and eloquent description of such meteors as they present themselves to the imagination of a universally-respected clergyman, now "Out of Harness."* We merely say, read "A Gale" in *Good Woods*. The actual truth of the subject presents no such attractions. Those, as Bacon beautifully says, who are under the "idols of the theatre, or of theories," will find the truth less poetically attractive. "The plot of this, our (cyclonic) theatre, resembles those of the political, where the plots which are invented for the stage are more consistent, elegant, and pleasurable than those taken from real history" or facts.

When Admiral Fitzroy chooses to give plain-sailing directions for seamen to avoid the dreaded centre of the cyclone, he can write plainly enough. No one has any difficulty in comprehending him. Thus, in the Board of Trade papers for 1861, he writes:—"Another simple result, deduced from multiplied observations, and important as it is simple, is, that in a gale or storm, while *facing* the wind, the centre of the circling or cyclonic current of the atmosphere is to the *right* in *north* latitude. Not that these rules are without *apparent* exceptions—*apparent* rather than *real*—

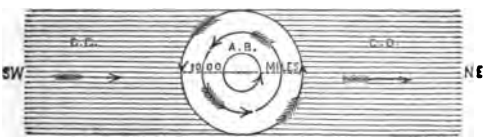
* Dr. Guthrie.

caused by a second, perhaps even a third, cyclonic (or oval) eddy impinging on the first circulation." As this was addressed to sailors, he might have told them that this rule always applied, excepting when the *prow* of a faster moving whirlwind ran into the *stern* of a slower moving one. From all this, we should have naturally supposed that this meant veritable circling, and not half-circling of the winds.

Admiral Fitzroy is quite aware that some experienced commanders, amongst them Captain Jinman, have come to the conclusion that the above rule for the guidance of seamen would "frequently lead them into danger instead of out." We shall see from the last paragraph in this number whether Jinman or Fitzroy is nearest the truth in the case of the Royal Charter storm. Captain Jinman, it seems, has as much cause to complain of the mania for converting every storm into a whirlwind, as we have often experienced, as a mere amateur. "Because," as he says, "the heights of the barometer, as noted in the different logs, did not agree with their ideas, they have put them down as *useless;* and again, because the bearings of the wind as noted did not agree, they have put those down who noted them as being something worse—in fact, they have been firing away pretty roundly on us poor ignorant merchant commanders."

We may as well here observe and show that the doctrine of cyclones, or revolving storms, is, even according to its own authors, a thing of threads and patches of inconsistencies. Our gallant Admiral has indeed taken the Herculean task in hand of attempting to weld them together into a consistent whole; but, in plain English, he may as well attempt to do so as any artificer might to weld clay and iron together. Mark the following facts:—The rotatory theory of Reid and Redfield was a thing easily understood, and it was the only supposition in which a veritable progressing and revolving storm could occur. The supposed vast whirl-

winds in our latitudes, which progressed without exception, we are assured, from south-west to north-east, were all said to be "imbedded" in a broad current of air moving from south-west to north-east. Thus, when a gigantic whirlwind, A B, of 1000 miles in diameter, is progressing at the rate of twenty-five miles an hour, then there must also be a current, C D, having a breadth of 1000 miles at least, moving at



twenty-five miles an hour. In regard to this point, Mr. Redfield says, with truth,—"That the progression of rotatory storms is caused by the predominant current in which they are imbedded appears nearly a self-evident proposition." Simply because such a revolving mass of air could not force its way through or displace the air in front of it. Now, we call upon Mr. Milne Home to say if we be wrong in stating that this was his original notion of what a revolving storm was. He is a man of ability, and can write better and plainer English than we can. We have often found reason to differ from Mr. Milne Home, but we have never had cause to complain that he disguises his meaning by a multitude of abstruse and unfathomable words. The above rotatory theory was also the theory of Lloyd and Stevenson of Dunse.

The next version of the rotatory theory, we must candidly confess, is above our comprehension or conception. It is the transcendental theory of Sir John Herschel; and it would be well for Admiral Fitzroy if he would try and bring its meaning down to the level of the understanding of ordinary men like ourselves. Here it is. Cyclones "consist of a

revolving movement, propagated from place to place, not by a bodily transfer of the whole mass of air which at any moment constitutes the hurricane from one geographical point to another, but by every part of the atmosphere in its track receiving from that before it, and transmitting to that after it, this revolving movement." We add no more, but say, Here is a task, indeed, for Admiral Fitzroy; for to us it is evident he must either prove this theory to be "delusive," or his favourite parallel current theory of Dové must be a delusion.

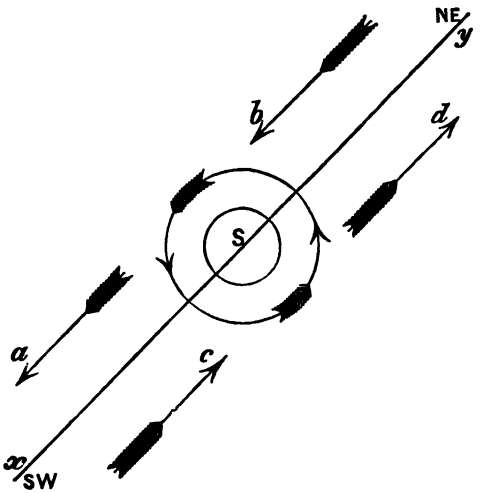
Yet, in those vague views and expressions of Herschel, there is a something which meets an insurmountable objection that applies equally to Dové's and Redfield's particular ideas. It is one that their supporters pass heedlessly by, and will not look at any more than a dog under rabies will at water. When our great poet created his fairy beings, he did not leave us to doubt or wonder how in their rapid flight they dealt with the viewless but ponderable air. Ariel informed his master, when sent on a distant errand, "I drink the air before me, and return or ere your pulse beat twice." The ethereal substance of the fairy found no more resistance in its passage through the liquid air than the shadow of mortal and material man. But the body of a progressive and revolving cyclone ought to be of a different texture and substance, although most cyclonists treat it as if it were possessed of little or none. In almost all the tropical hurricanes, for instance, and in many of our great winter storms, travelling at the rate of upwards of thirty miles an hour, the air is often in a state of repose or calm in the very track of their course. How, then, can a rotatory storm drink, swallow up, or dispose of the mass of stagnant air in front of it? Or, what becomes of the cushion of air through which a cyclone must dash when it overtakes and runs into a slower-moving fellow-traveller? These are two plain

questions which ought to have as plain an answer, if the doctrine of cyclones be not an airy nothing. Storms are clearly not altogether things of mere progression. The air on the day preceding the Royal Charter storm was almost a dead calm over Scotland and a large portion of England. In a subsequent number we shall try to make it out that the mass of air which formed the terrific blast on the Welsh coast at sunrise of the 26th October, 1859, was no part of a revolving storm from the southward, but was probably lying in a state of repose at sunset of the 25th somewhere along the southern flanks of the Grampians.

We remember calling the late Mr. Redfield's attention to the fact that Dové's views were very different from his own. "Oh, yes," was the reply; "but Dové has yet got a very inadequate idea of the true law which governs the winds." The difference between Reid and Dové is great indeed. Dové laid down the doctrine about ten years ago that, while the winds in the tropics stratified the one over the other, *in the temperate latitudes they flow side by side.* Cyclones, according to Dové and his follower, Admiral Fitzroy, are not embedded in currents, but result from the "meeting" of two currents—one from the north-east, and another from the south-west—flowing side by side. We illustrate this from the figure as given by Kaemtz. Thus, if we suppose A B is the north-east or polar current, and C D the south-west or equatorial current, flowing side by side at X Y, a whirlwind storm (s) revolving from right to left is the result of these parallel currents moving in opposite directions.

It will thus be seen that, when any one assails the theory of rotatory storms, he has to deal with a hydra-headed object, whose supporters play fast and loose with you, making believe that their combined authority is worth a deal when it is in truth mutually destructive. For, by bringing them face to face, as we have now done, the one

neutralises the other. Ere they settle their differences, we are hopeful that they will leave little to differ with us about;



for, like the encounter of certain feline animals in a neighbouring island, there will be little left behind. It is evident Admiral Fitzroy is soon to treat the whirlwinds, pure and simple, as a joke, and is to be satisfied with a mere remnant —something that may either be "curvilinear, half-circling, or cyclonic."

One theory—that of Dové's—we have not disposed of; but in the meantime we leave Dové's, to dispose of Herschel's and Redfield's. In another number, when we accept of Admiral Fitzroy's challenge to treat of "the meeting of the winds," we think we will be able to show that Dové's and Fitzroy's view are utterly irreconcilable with the facts of the Royal Charter storm.

One thing that our self-contradictory opponents, whether Redfield, Herschel, or Dové, and all their followers, used to be agreed upon was, that the winds, one way or another,

formed graceful circles around the common centre of the storm. Fix your centre and take the compasses, and you could show at once how the wind *should* blow at any spot. Let us once more take a look of a thing of such simplicity and poetical beauty. Its symmetry and *its* "real integrity," alas, are about to be sadly marred.

When the Royal Charter was wrecked by the norther on the coast of Anglesea, about seven o'clock on the morning of the 26th October, 1859, Admiral Fitzroy leads us to suppose that the centre of the storm was then somewhere to the southward of the locality of the wreck. He may fix the exact spot for us if he chooses—he has not yet done so. A few miles on this side or that, it is evident, is of little consequence, as it would little affect the almost "straight-lined" winds of the outer circles that ought to sweep over North Britain from the south-east and east. Well, let us again take the compasses in hand, and fix the centre south of Anglesea; A B C D are its circles, which the sailor is told must correspond in all cases with the directions of the winds. About sunset of the 25th October the wind began to blow from the north-east on the northern shore of the Firth of Forth, and by morning it was blowing a gale from the base of the Grampians almost straight towards the scene of disaster at Anglesea. The northerly wind was thus blowing at right angles to the hypothetical direction, and almost straight to the centre of the circle. But this was not all; the south-west winds in the south-west of England were blowing at right angles to the hypothetical or cyclonic direction. In the south-eastern parts of England they were also blowing as south-east winds, heedless of the should-be direction. There was not much wind in the north-west of Ireland, but there, also, it was generally from points between the north and west. Fitzroy so far admits this; for he is obliged to confess that "the distant winds," instead of

circling round the area of low barometer, blew towards it. No advocate of the circular theory ever before made such a

confession, and it is directly in contradiction to the simple but unfailing rules which he gives to the sailor when he wishes him to avoid the centre. In our next number we shall show that the early opinion of Sir John Herschel treated such a supposition as in-blowing winds as almost a physical impossibility.

The area of disturbance in the Royal Charter storm was of immense dimensions, and at one stroke of his pen Admiral Fitzroy virtually robs the cyclone of two-thirds at the very least of its former reputed territory. If this storm is a fair sample of others, it is a gross mistake to suppose that there can be cyclones of 1000 miles diameter.

But Admiral Fitzroy consoles himself with the idea that he has still preserved a remnant from the wreck, which has

really something of a circular character about it. The rotatory theorists must feel anxious as to the safety of this vestige of a noble theory. Well, here is the proof that is led by Fitzroy, and any one may give a verdict on it, as the facts of the case are so plainly stated.

Fitzroy informs us that Colonel Austen took great pains to investigate the Royal Charter storm from Cornwall to Lincolnshire, and both look upon the data furnished as conclusive evidence of the truth of the cyclonic theory. To us, the facts supplied, and the use made of them, furnish an extraordinary instance of the effects of the cyclonic mania. The Colonel tells, and Admiral Fitzroy endorses, not only all he says, but all his conclusions. "Dover, Plymouth, and Liverpool, form on the map nearly an equilateral triangle; and the same cyclone was in this instance blowing a south-east storm at Dover, and from north-north-west at Liverpool, having just been blowing from the south-west at Plymouth, under the influence of the self-same whirlwind."

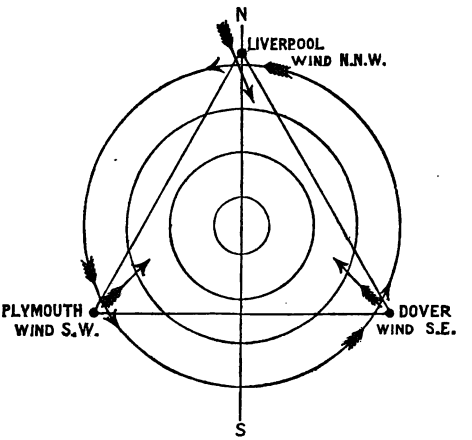
When we read this nearly three years ago, we had then the secret satisfaction of thinking that Fitzroy had at last put the whirlwind of the Royal Charter storm into "a tight place," out of which it would be a somewhat difficult matter to take it. Can his new (? ! ! !) convert, Lieutenant Maury, or any one of his "followers," whom he says are "legion," aid him in this the hour of cyclonic trouble? Ye cyclones, where are thy sweeping gyres and graceful circles now?

Let us make an equilateral triangle, and take our compasses also, and see how the directions of the wind, as indicated by the arrows, correspond with the tangents of the circle.

It is useless to argue the question in words. The problem is, who will undertake to describe a circle that will embrace or take in these three arrows, so as to make tangents of them. Are they not radii rather than tangents?

We think it is near the truth to say that the winds, as

indicated by the arrows, were blowing towards the centre of the triangle, and could not possibly be circular. The north wind at Liverpool is blowing right across the should-be



direction, and any deviation from this is in the teeth of the hypothetical direction. The south-west wind at Plymouth, and the south-east at Dover, also point inwards. The winds, Colonel Austen even tells us, veered from *south-east* to *south-west* along the whole coast from Dover to Plymouth. These southerly winds *should not* have been found in the base or south side of this equilateral triangle, but in its eastern or right hand side. Those who commit such blunderings, we submit, must be under the influence of some *mania*. We gave an outline of the simple principles which determine these veerings in No. III., which any one will find it much easier to sneer at than refute.

It was through the sides of this equilateral triangle that the cyclone or whirlwind (if there was any cyclone or whirlwind) must have passed. It thus forms a gauge by means of

which, though we cannot tell how *small* it was, we can safely say it was not so large as to fill up the area between Liverpool and Plymouth. The north wind, we need only observe, which blew almost in a straight line from the base of the Grampians to the Mersey, was a barrier through which a cyclone could not possibly pass. Fitzroy thought, after having the facts before him, that there was still evidence of a cyclone from 300 to 400 miles in diameter; but it is evident that it could not by any means be half so large as the latter figure. It is little more than 200 miles from Liverpool to Plymouth, and this was the breadth of the gateway through which it must have escaped in its passage from Cornwall to Lincoln.

Thus, its sadly dwindled size, of whose existence Admiral Fitzroy has not yet furnished one solitary proof, must have been limited to that area over which the rude winds, "winged from the spongy south" on the one hand, and the icy north on the other, were arrested in their wild flight. The cyclone, in short, has escaped from us, and hid its diminished head in that neutral territory which those opposing winds respected. This may be termed their place of meeting, which Fitzroy makes known to us as having taken place in succession somewhere near the spot indicated by the two parallel lines on our small map. What brought these winds hither? what was the nature of the command they obeyed, "hither shalt thou come and no farther?" where they went? what effects they produced?—are all points which we hope to touch upon when we treat of the "meeting of the winds."

One word more just now. We think Admiral Fitzroy might have been more on his guard when such evidence of a circulating storm was presented to him as was done by Colonel Austen. He had discovered that these outside or "distant" winds at Dover and Plymouth were in-blowing, and surely it was too much to expect that they could be at

the same place and time both in-blowing and also circulating. On a par with this is the blunder which the Admiral commits, in his "Weather Book" and blue books, in supposing that the veerings of in-blowing winds can possibly be accounted for on the cyclonic hypothesis when they are acknowledged not to be cyclonic. This is little better than an attempt to prove that the tangents and radii of a circle are one and the same. The truth of all we have said peeps out in a practical shape in another direction. In what locality does the rule—said to be without any exception, which Admiral Fitzroy gave to sailors for finding out the dreaded centre—hold true in the case of the Royal Charter storm? During that memorable storm, the sailor would not find the centre (if such there really is) by turning his face to the wind and then looking to the right, but by simply turning his back to it and looking straight before him. The latter was the rule as applicable to the Firth of Forth, the Mersey, and the whole south coast of England; and our arguments all lead to this conclusion, that Admiral Fitzroy has failed to prove that anything in the shape or form of a vast whirlwind storm passed the meridian of Liverpool on the 26th October, 1859. But we suppose we must begin to build up after having pulled down so freely. We have surely said as much, however, as to entitle us to ask our opponents to reconsider the whole question, and in the name of progress "think it is possible" that they may have hitherto been "mistaken." We will be very glad to treat them with courteous deference if they cease to lord it over us by merely quoting multitudes of authorities whom they do not seem ever to have studied other than in the most cursory manner. But we do not dictate in this matter; let them take what course they choose which shall try to lay bare the truth.

No. III.

The weather over England, Ireland, and Scotland was remarkably cold for the season on the 24th October, 1859, and in most places north of Liverpool it was still colder on the morning of the 25th. On that morning the thermometer was as low as 24 degrees, Fahrenheit, at Highfield House in Nottingham; 25 degrees at Norwich; in Scotland, 32 at Southcairn; and 17 at Castle Newe, in Aberdeenshire. In the north and west of Ireland the temperature was also generally at or below the freezing point at sunrise of the 25th; northerly winds had been prevailing for some days previously, and had transported a vast body of cold and dry air into a lower latitude. Excepting a few localities, little snow or rain fell with the north winds up to the evening of the 25th. The characteristic feature of the weather for some days previous was unusually hard frosts for the season.

There was much hoar frost on the morning of the 25th; and all north of Liverpool during the forenoon the air was generally in a state of calm. Though the air at the surface of the ground was at rest, it was evident that a change was taking place in the higher beds of the atmosphere. Not only was the temperature everywhere rising as the day advanced, but there was also an increase in the amount of moisture in the air. The dew-point at Highfield, in Nottingham, at half-past three o'clock P.M. on the 25th, had risen 12 degrees, though the air seems to have been quite calm up to noon. An easterly breeze set in at Highfield early in the afternoon, and gradually increased to a rough wind by sunset, and a violent gale by ten P.M.

One remarkable circumstance that ought to be particularly noticed is that, while the northerly winds on the days previous to the 25th were dry, moderate, and bright, those on the

26th were violent, wet, and the sky was overcast and troubled. Indeed, the north and north-east winds on the 26th over the greater part of Scotland were remarkably wet and stormy. At Mungo's walls, ten miles west from Berwick, three inches of rain and melted snow fell during the night of the 25th, and next day till dusk. It also rained over the whole north-east of Scotland on the 26th. At Wanlockhead, Castle Newe, Sandwick, in Orkney, East Yell, in Shetland, large quantities of rain or snow fell according to the elevation of those places.

From what source was the north and north-east winds supplied with such an amount of moisture as fell in rain on the night of the 25th and following day over Scotland! We have yet a vivid recollection of the appearance of the sky about sunset on the 25th on the northern shore of the Firth of Forth. A brisk current from between the south and south-west was bringing up dense cirrous cloud, which had already suffused the sky as with a thick veil. In a lower stratum small electric-looking cumulus clouds were drifting like the higher and more regular depositions of cloud towards the north-eastward. The upper current was from the southward during the whole of the 25th over the middle districts of Scotland; and we have no doubt *it was the same over the whole of Ireland and England.* Upon what other hypothesis can we possibly account for the immense fall of rain that occurred on the 25th and 26th over England and Scotland with the *easterly* winds?

We have long been accustomed to watch our rainy north-easters; and we never knew of an instance in which such a large area of country was deluged with rains as occurred on 26th October, 1859, without a southerly current overlying them, and acting as a reservoir of moisture. The great sleet and snow storm of 6th and 7th March was of this character. Snow then fell in some parts of Scotland without

intermission for forty hours, and the thermometer did not vary more than two degrees all the time. The north-east wind brought the cold air in below the southerly upper current, which afforded moisture for the snow. During a temporary and slight breaking of the sky on the forenoon of the 7th, the clouds were seen drifting from the south-west. While the snow fell in Scotland, southerly winds prevailed in the south of England. It is the southerly upper current being comparatively warmer and lighter that causes the barometer to fall during rainy east winds.

The east winds that are prevailing as we write (27th April) are attended with a high and steady barometer. The air, being dry, cold, and heavy, contracts and sinks down, and must cause a depression at the top of the atmosphere. The air, therefore, flows in above, and the pressure is increased at the surface of the earth. During the prevalence of such keen and dry east winds, no clouds are observed in the upper strata having a course from the southward.

Over a considerable part of Ireland the barometer fell on the 25th, but the sky remained clear; and the air at the surface of the earth was little disturbed. Fitzroy mentions this fact, but does not attempt an explanation. This, we say, merely shows that a warm and moist south or south-west current was prevailing above. We have known instances in which the barometer fell with a north wind and an almost clear sky north of the Frith of Forth, while all south of it immense quantities of rain fell. The upper current, being in this case from the southward, failed to saturate the air at the surface of the ground further north than the Forth, and, as a matter of course, the north wind retained its dry and cold character till it reached the edge of the rain-bearing cloud.

It is particularly worthy of remark, that the barometer

on the 25th October, 1859, seems to have fallen to a much greater extent in some parts of Ireland where there was no rain and no storm, than in many parts of Scotland where the wind was violent, and much rain or snow fell. Though the barometer fell in Scotland on the afternoon of the 25th, the wind did not blow with any strength till the rain began to fall. The southerly upper current had been prevailing all that day, and affecting the barometer, but it did not disturb the air below until the rain commenced. The process of saturation had been going on during the day; and from this cause, by sunset the air, over a very wide stretch of country, was in a state of unstable equilibrium, and the storm was ready to break out in all directions.

A few instances of this may be given. In Scotland, heavy, rain began to fall before midnight of the 25th. At Drumlanrig, there was brisk lightning by eight in the evening. By midnight, too, it was blowing a gale over the whole of Scotland south of the Grampians. On the Lammermoors, the night of the 25th, and almost the whole of the 26th, till dusk, was the severest snow-storm that occurred during the memorable stormy winter of 1859-60. In some places on these hills the snow was blown into wreaths twelve feet deep, and, with the additions it got during the winter, did not disappear till the following month of May. There was little wind at Holyhead harbour till 6 P.M. of the 25th, when the sky became dense; but "a perfect hurricane" raged at 9 P.M., with "a deluge of rain." Curious enough, Liverpool, which seems to have been within one of those areas over which the winds had their place of meeting, or, strictly speaking, where part of them ascended, did not feel the storm with any force till 9 A.M. of the 26th, two hours after the Royal Charter was wrecked. But it is worthy of remark, that the saturating process had been completed much sooner at Highfield, in Nottingham, than at Holyhead, for

the rain began to fall there with a north-east wind at 4·15 P.M. At Norwich, a great deal of rain fell in the evening. The southerly upper current had saturated the air at the surface of the ground with moisture during the afternoon and night of the 25th, over an immense area, so that the elemental warfare burst out, when the rain began to fall, at places widely separated from each other.

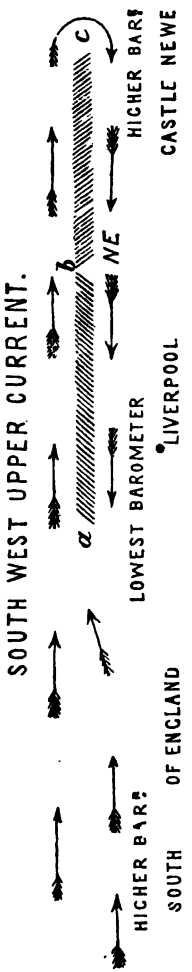
During the night of the 25th October, the north-east wind was blowing almost straight on to Anglesea from the Grampians; southerly winds were blowing in the south of England, or almost right towards these north winds. But while the north-east blast on Anglesea in the early morning of the 25th was probably under 3000 feet in depth, the south-west current above could not be under 15,000 feet. The north-east wind was simply owing to the cold stratum of air that was lying at the surface of the earth. The south-west upper current could not push this cold mass of air before it, and, as in the case of the sea-breeze on our coast in summer, it flowed back underneath it. Rains had been falling to the south of Holyhead long before the storm broke out there, and the latent caloric evolved had heated the air in the higher strata. As Dr. Tyndall says, the heat evolved is first energetically expended in expanding the air above, and thus exerting a lateral pressure. This lateral pressure, it is easily seen, would check the flow of the south-west upper current from the south-west; but, on the other hand, it would assist its propulsion above towards the north-east. The barometer stood lower south of Liverpool than it did in Scotland. We thus at once see the reason why the north-east winds in Scotland were driven southwards in obedience to the universal law that regulates the motions of the atmosphere; that the wind blows from a higher towards a lower barometer at equal elevations above the sea level. So, too, the barometer was higher along the south coast of

England than it was 150 miles farther north, and thus the winds were southerly during the gale.

It may be as well here to remark that the south-west current above is under the influence of the same law as the winds at the surface of the ground. The column of air of the south-west wind is warmer, and thus more expanded over the Bay of Biscay than over the north of Scotland, where the column of air, from being colder, is also shorter. And thus, though the barometer stands higher at the sea level in the north of Scotland, it would stand lower at an elevation of 10,000 feet than at the same elevation in the Bay of Biscay. The air in the upper current, therefore, is flowing down an inclined plane, or from a higher towards a lower barometer. This is merely a repetition of the same principle or law which all acknowledge guides the sea breeze on our coast and the trade winds within the tropics. The following figure will assist in affording clearer conceptions of this mutual action of the upper and under current.

The arrows represent the north and north-east wind descending at Castle Newe. This does not take place there, however, in a body to furnish air for the northerly wind, but, as in the case of the air, to supply the sea breeze over a considerable space from *b* to *c*. So, also, the air does not rise in a body where the barometer is lowest, but over a considerable space from *a* to *b*. The moist north-east wind acted as a sort of wedge on the upper south-west current where it ascended from *a* to *b*. It is thus the means of causing further deposition of rain by expanding and cooling as it rises and comes under less pressure. Immense quantities of rain and snow fell on the 26th October, 1859, from the northern slopes of the Lammermoors to the sea coast. But after the north-eastern crossed the high water shed, very little rain fell at Dumfries and other places immediately to the southward of the hills. So, too, when the air was de-

scending—say at Castle Newe—on the morning of the 26th, no rain or snow fell till 8 A.M., and at Elgin the rain only began to fall at 9 A.M. As soon as the south-west upper current saturates the air to the north of Castle Newe, the northerly winds at the surface of the earth become rainy, and the area over which it descends is transferred further north. It is for this reason that the rains and winds sometimes appear to travel from the south. *Rains come from the south*, but the currents which bring them are propagated *from west to east*. Both in America and in Europe the rains usually begin to fall in the west, and thus they appear to travel towards the east.

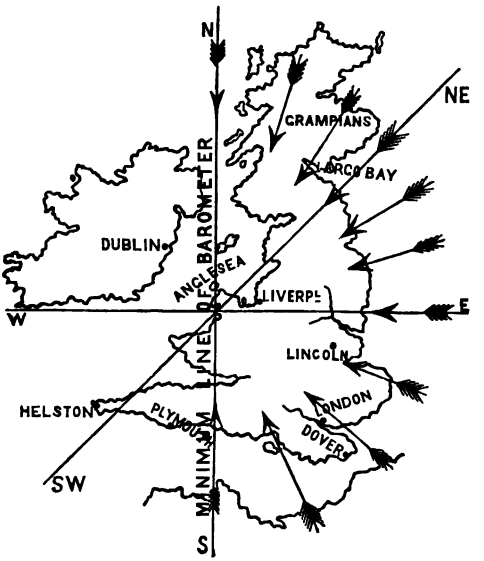


Sir John Herschel says, in the "Encyclopædia Britannica," there is only a difference of 0·24 inch of mercury between the sources and the termination of the trade winds. This slight difference, however, is constantly in action, and is sufficient to propel the two trade winds. Over the most of their coast the sky is serene, and winds are gentle and regular. If a small cloud, however, does anywhere cross the zenith, as Humboldt observes, it creates slight gusts as it passes. The extrication of caloric within the cloud disturbs the general equilibrium, and causes the air to gyrate, not horizontally, but vertically. The sea breeze, too, of summer

is steady when the air is bright and clear. But, let the sky become overcast with clouds and rain fall, and then the winds become gusty, squally, and irregular. So we need not wonder when we find the north-east wind rise to a hurricane, as in the case of the Royal Charter storm, when it is snowing or raining for nearly 300 miles over its course. In reading the works of Dové and Fitzroy, we are often led to imagine that the winds during storms are, as it were, blown from the cheeks of Eolus, or hurled either from the equator or the poles. But it ought always to be borne in mind that the force that propels winds, like the flow of a river, or the strokes of a boy driving a hoop, is everywhere exerted along their course. Every drop of rain which falls has as much potential energy as the same quantity of water evaporated in our steam engines. The air remained at comparative rest over Scotland until the rain began to fall. Then it began to move slowly, like a stone rolling down a hill, and was soon accelerated and driven with frightful violence towards the area of lower barometer. Some notion of the enormous energy evolved by the latent caloric in rainy storms may be formed if we would attempt to estimate the number of windmills that the north-easter could have driven on the 26th October, 1859.

The barometer was lowest south of Liverpool as the storm touched England. Instead of due east winds being found on the northern verge of the storm, as would have been the case had the winds been circular, they are mostly found to the *east* and *west* of Liverpool as the storm approached. Thus, the winds were first from the east, both at Holyhead and at Highfield in Nottingham. At the former, the due east wind set in at nine in the evening, and at the latter about midnight. At the same time, the winds were from the southward along the south-east coast of England. A small chart, however, will illustrate this, and show the

general principle that regulated the direction of the *east* winds in Britain about 2 A.M. of the 26th. We have drawn



a line on the small chart about due north and south, and marked *line of minimum barometer*. All the winds to the west of this line are regulated by a different agent from those on the east side. In the meantime, don't let the reader disturb himself about the nature of the agent that comes into play, and turns and directs the course of the winds on the west side of this line. This shall be treated of afterwards. It is with the winds on the east side of that line that we have now to do. All the easterly winds are so far regulated by the minimum point or area of low barometer. To this point most of the easterly winds tend. We challenge Admiral Fitzroy to fix upon the point or central area of lowest barometer at any one moment of the night of the

25th October, or early morning of the 26th, and show how far we are wrong in our hypothetical direction of the easterly winds. We don't mean to say that they were so symmetrical as is here represented, but they were rather of the nature of radii than tangents of this half-circle.

In describing our fourth figure, we have made a mistake in saying that the figure represented the winds over Britain when the Royal Charter was wrecked. We should have said on the night previous, or about 9 P.M. of the 25th, at the time when the northerly winds were establishing themselves over Scotland. The *point* or area of low barometer was then to the south of Liverpool as stated. This will render the first part of the paragraph consistent with the last. The north winds then received their direction over Scotland, which they maintained without veering for eighteen hours—indeed, long after the cause of their original motion and direction had been swept away in the south.

In all the rainy east winds of the 25th and 26th October, 1859, whether from the *south* round by *east* to *north*, an upper current overlaid them from some point between *south and west*. This relatively warm upper current brings moisture, and causes the barometer to fall. The longer the winds usually blow from the east, the warmer they become as they are affected by the upper current. Very frequently, when they become warmed to a sufficient degree, the south-west upper current establishes itself at the surface of the earth. Thus, at Highfield in Nottingham, the wind changed from NE. by E., through ENE., E., by N., E.; ESE., SE., S., SW. The south-west upper current was gradually gaining ground in that latitude, and changing the focal area further towards the north. It is the merest trifling with the whole subject to assert that these changes are due to, and can be explained by, supposed rotatory movements of the atmosphere.

We said that there was a *minimum point* of barometer which moved up or down the *minimum line* of barometer. When the minimum *point* moves towards the north, the southerly winds are then merely establishing themselves at the surface of the ground, and driving the easterly and northerly surface winds before them. According to Admiral Fitzroy, southerly winds were prevailing over Portugal and France during the storm of the 25th and 26th October, 1859. It was also probable that they did so to the west of Portugal, on the 25th. As a matter of course, these winds must have stratified over our easterly and rainy winds during both of these days. But one curious thing connected with the propagation of south and south-west winds, whether as upper currents or as winds at the earth's surface, is, that they seem in all cases to begin in the west; and the current is maintained and widened towards the east by, as it were, fresh additions to the eastern edge of the current. We need not here enter into the grounds for our arriving at this conclusion. We shall only say that it does not seem possible to account for all the phenomena of the great storms of rain and snow that sweep over the continent of Europe during winter on any other supposition.

Suppose, then, the winds were established as an upper current over the Atlantic to the west of Ireland on the 24th and 25th October, 1859. It did not blow long enough to saturate the air there so as to produce rain and storm, though it caused the barometer to fall. According to the Board of Trade papers, "the first of the gale was felt at Dunmore in Ireland on the 25th from the north-east." But as the south-west winds were rapidly established towards the east as upper currents, the whole country, from Land's End to the Grampians, was saturated by sunset of the 25th, and, as we have already said, the storm was ready to burst out with fury in all directions over this area.

Perhaps, however, a small figure will show this process more clearly. The shaded lines exhibit the area over which

it was raining and blowing on the 25th and 26th. The south-west upper current is gaining on the easterly and northerly winds as we travel towards the east. To simplify the matter, we suppose that the surface winds are all either south-westerly or north-easterly. They are, as it were, fighting for the mastery over a line which appears to have been somewhat in the direction indicated in the chart. We need only again observe that the north-easterly wind is a thin surface current flowing beneath the southerly upper current. The process is a very simple one, and, as we have often said, only a repetition of the same principle that we find in the sea breeze.

But we shall treat of the *minimum line of barometer* afterwards. This is altogether a tender point with cyclonists.

Most of them never heard of it, and never mention it in their writings. Admiral Fitzroy has only yet got the merest glimmerings of its nature and existence; although, as we

shall afterwards show, his forecasts regarding coming storms are or ought to be principally founded upon it and its attendant phenomena. We are glad to see that M. Le Verrier, of the Paris Observatory, following in the footsteps of Espy, has now begun to lay down daily the *minimum line* of barometer over France on charts. A full discussion of the whole phenomena attending this is most anxiously to be desired. The beautiful charts of the winds over Britain laid down by Mr. Babington, of the Board of Trade, are sadly lessened in their value by no attention being paid to this subject. It is a parallel case to representing a well-known play with the principal character left out.

No. IV.

In the cutting of the figures which we have considered necessary to enable our readers to follow us, a good deal of time has been required. When we had also proceeded so far in writing out this number, the last report by Admiral Fitzroy to the Board of Trade, through his attention, came to hand. This document has caused us to recast our remarks, as it contains some new matter of special interest and bearing towards ourselves. To avoid disconnecting the arguments, our readers will be good enough to bear with us in two somewhat lengthy articles.

We must first call our readers' attention to the *minimum line of barometer* which occurs in all great storms. That the barometer begins to fall as well as rise at the same moment, at places which are situated at great distances south and north from each other, is a discovery that Espy brought prominently into notice. This is more particularly true, however, of the winter storms, both of America and Europe. This long line of low or minimum barometer corresponds, as

we have formerly said, with the "trough" of the "atmospheric waves" of Birt, Nichol, and Herschel. But the writings of Dové, Reid, Lloyd, Stevenson, Milne Home, and other advocates of the rotatory theory, do not contain a single reference to this well-established phenomenon. It is only very recently that Fitzroy, who has certainly not been looking for it, has become aware of its existence. When it does occur, he seems to imagine that the case is peculiar. Redfield, the clever advocate of the whirlwind theory, stoutly denied its existence altogether, as he was acute enough to perceive that such an admission virtually undermined the whole structure of that hypothesis. The views and deductions of Espy, Hare, Redfield, and Fitzroy, will prove the best introduction to the subject:—

"The central line of minimum pressure in American storms is generally of great length from north to south, and moves side-foremost towards the east. The line is sometimes nearly straight, *but generally curved, with its convex side towards the east.* There is generally a lull of wind at the line of minimum pressure, and sometimes a calm."—*Espy.*

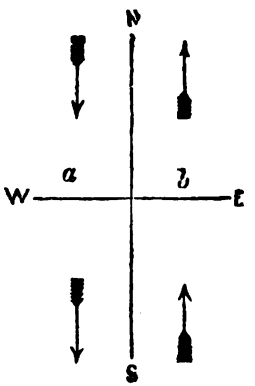
"Agreeably to most ample and satisfactory evidence adduced by Loomis, as well as by general experience, some of the most violent storms of the American continent travel from north-west towards the south-east."—*Dr. Hare's Strictures on Dové's Essay.*

"'The enormous length of the area of minimum pressure comparatively with its breadth' I conceive to be founded mainly in the error of mistaking the *path* of 'minimum pressure' for its *area* at a given moment."—*Redfield's Reply to Dr. Hare.*

"During the storm of last October (29th and 30th), such remarkably sudden and violent shifts of wind took place about the same time at many places in nearly *a meridional direction* [line?] across England [ay, and across the

continent of Europe if you had looked for it], between or by Oxford, Greenwich, Nottingham, and other places, that to meteorologists even they seemed unaccountable; but if we contemplate parallel currents side by side, moving rapidly in opposite directions, and having also *a lateral movement to the eastward*, such sudden and meridional changes may become as easy to comprehend," &c.—*Admiral Fitzroy in Times, 2nd December*, 1863, *and Board of Trade Report for* 1864.

From this last extract, we see that Fitzroy, unlike Redfield, does not deny the existence of changes in the character of the weather occurring simultaneously on the meridians. He endeavours to explain them, however, on the parallel-current theory of Dové. We suppose we are right in thinking that Fitzroy forgot to state that the barometer began to rise during the storm of October, 1863, at the same moment at all places on the same meridians. To account for the whole phenomena, Fitzroy supposes that a due north and a due south wind are blowing in two parallel currents, as represented in the figure, and that these two currents have at the same time a lateral motion from *west* to *east*. The low barometer, being found on the western edge of the south wind, would begin to rise as soon as the north wind was translated over any place.



This theory of a lateral motion is an addendum to the

parallel current theory of Dové. But, in every aspect in which the phenomena connected with the simultaneous meridional changes of the weather can be viewed, this hypothesis will, at the most cursory glance, appear utterly indefensible. If Fitzroy had only ascertained the rate of the "lateral motion" of the winter storms, he would hardly ever have proposed such an explanation. In the case of the American winter storms, the meridional line of minimum barometer, with its accompanying sudden changes of winds, temperature, &c., has what Espy calls a sideways, or Fitzroy, calls a "lateral motion," of thirty-six miles an hour. In the great storm of 6th and 7th February, 1856, the meridional changes had a lateral motion over England and the whole of western Europe not far short of forty miles an hour. In such storms, the lateral motion would often be greater than the air in the parallel currents themselves! And, pray, what about calms that also lie from north to south, like a bank, to the eastwards of a storm region? Have they also a lateral motion of translation? But even if Fitzroy's explanation could have stood a breath of criticism, we only reach a higher difficulty as to the agent which imparts the lateral motion to the parallel currents. Such theorising might have been excusable in a mere "amateur," but it is scarcely so in one who ought to be capable of making it at least physically consistent with facts.

But, over and above all this speculation, there is no evidence whatever as to the existence of parallel currents. The whole phenomena of the Royal Charter and other storms are explainable on the supposition that *the south-west winds, as under or upper currents, bring the rain or snow, and cause the barometer to fall, and that the west or north-west wind blows them away, and causes the barometer to rise.*

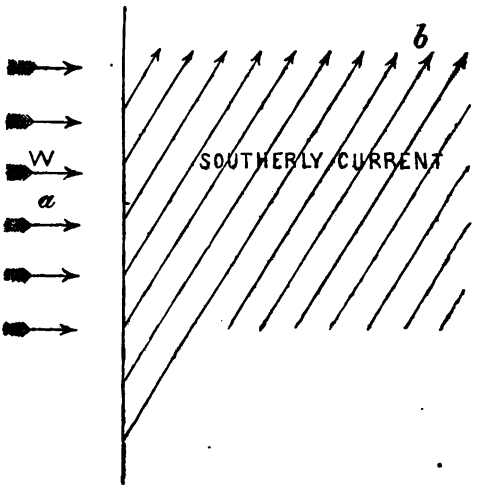
When the wind is from the south-west the temperature is high, and the quantity of moisture in the air large. As

soon as the west or north-west wind sets in, the temperature sinks, and the quantity of moisture is diminished. Admiral Fitzroy wrote, as the result of his experience, so far back as 1838—"One wind usually brought the 'dirt,' to use a sailor's phrase, and another cleared it away. One of these currents was warm and moist; another cold and dry, comparatively speaking. While one lasted, the barometer fell or was stationary; with another it rose." Fifteen years ago we used to quote these words of Fitzroy against the rotatory theorists. They contain the nucleus of our own views, and we consider them the soundest he ever uttered. We were only sorry when, in later times, he adopted the terms and phraseology of the cyclonists, and, like all new converts, became quite intolerant of any other views and opinions which are anti-cyclonic.

The first distinct intimation we get of the upsetting or clearing away of the moisture or dirt-bringing south-west wind by the north-west wind in the Royal Charter storm was by Admiral Elliot, on board one of the channel squadron, then not far from Eddystone Lighthouse. A southerly gale had been blowing there all forenoon of the 25th October, 1859; but it ceased about three P.M. There was then *a calm for half-an-hour;* but all at once "a blast swept furiously from the north-west," and then the barometer began to rise. This, we hold, was merely the west wind upsetting or driving away simultaneously all the other winds along the meridians, which caused the barometers to rise simultaneously along the meridians. The rate at which the barometer begins to rise along the meridians only shows the rate of progress of the broad westerly current towards the east.

The cold west winds, *a*, indicated by the arrows, enter below the warm south-west winds, *b*, and push them into the higher strata of the atmosphere, where it is swept

towards the east by a still higher current from the west. This westerly current is supposed to be constant at 30,000



feet; it forms the anti-trade current of Henry and Herschel. We have thought a good deal over this point, and do not know of any objections that can be urged against these views. Their application to the facts of the Royal Charter storm will now be exhibited.*

* We did not intend to allude to Espy's views as to the cause of the line of low barometer, but a paragraph in Fitzroy's Report, just issued, renders this necessary. There need be no indelicacy in us appropriating the rebuke as intended for ourselves.

"In this country, some *misquote* the lamented Espy (who said that the wind blew from places of high barometer to those of low pressure), by ascribing to him a most unmathematical corollary, that all gales are "straight lined," and that cyclonic circuits are "fallacies." Such persons, surely, betray themselves. Air moving from various places of high tension towards a limited area of *depression* must meet, and have a tendency to gyrate, being unable to go upward on account of

The south-west winds being warm, and therefore light, cause the barometer to fall. When they are cut off by the cold west wind far to the southward, as represented, this cutting off does not interfere with their flow towards the north-east. On the contrary, owing to the barometer rising with the cold west or north-west wind, an addi-

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gravity. Any such upward determination must tend, however, by its overflow to augment the tension and pressure about the outer portions of any such circuit."

It does not require much logic to perceive that the last sentence in this paragraph is in direct antagonism to the one that precedes it. If air were unable on account of "gravity to go far upward," there could be no "determination" tending to "its overflow." And as for the first sentence, it "betrays" Fitzroy's total misapprehension both of our own and Espy's views; and every word in it is a misquotation, excepting the last six, which refer to the cyclonic circuits. In truth, a prime point of difference between our own and Espy's views consists in the extent to which the *in-blowing winds* in storms rise in the atmosphere against gravity. Espy held that the occurrence of the long meridional lines of low barometer was occasioned by the winds on both sides blowing obliquely or directly towards them, and then *rising in a body to the top of the atmosphere* and overflowing towards the east. We hold that the air in these in-blowing storms does not rise in a body, but over all parts of the surface where the barometer is falling, and that the air in storms is seldom disturbed at the height of 30,000 feet. There is no "unmathematical corollary" in either our own or Espy's views, for both he and Tyndall show that "gravity" is a mere zero to some of the other forces evoked during storms. And, what is more, even though winds "had a tendency to gyrate," they must "go upward" against gravity when they blow towards each other. But to show how little gravity really acts as a counteracting force, we have only to bear in mind what every one admits, that the sea breeze and the trade winds all go upward against gravity. The air in these cases as well as in storms moves from "spaces of high tension towards an area of depression," and yet has "no tendency to gyrate." We ask Fitzroy to bear in mind that, in contradistinction to Espy, we hold that the south-west wind, as an *under* or as an *upper current*, unless on the southern borders of great storms, blows away

tional force is imparted from behind. Thus, the southerly winds that were *overlying* the north-easters in Scotland about sunset on the 25th October, 1859, were already cut off in Cornwall by the north-wester. The south-west upper current over Scotland, with the north-easter under it, continued to revolve like an endless web until they were also upset or cleared away by the west wind that influenced them on the forenoon of the 26th October. These changes in the wind, from an easterly to a westerly direction were taking place at the same moment over a very long line stretching northwards and southwards. Instead of this taking place on the meridians, like the storm of the 29th and 30th October, 1863, mentioned by Fitzroy, the line of changes was curved or crooked. Like many of those which Espy traced out in America, it was greatly "*curved, with its convex side towards the east.*

Let us first ascertain the rate at which this line of minimum pressure of barometer and changes in the character of the weather took place over England. This we can do with considerable accuracy, so far as regards the south of England. The meridians of Eddystone and Greenwich are about 190 miles apart. The barometer began to rise at the former at 3-30 P.M. of the 25th October, and at the latter at about 5 A.M. of the 26th. This gives a rate of progression of fourteen miles an hour.

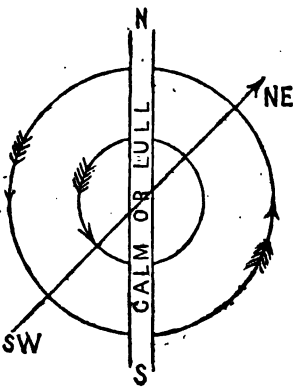
We must here have a word with Admiral Fitzroy. Why has he given us no account in his "Weather Book" or Board of Trade Report, as to the time the minimum barometer occurred in the north-west and south-west of Ireland on the

from instead of *directly or obliquely* to the line of minimum barometer. The south-west current at first overlies the whole stormy region. We repeat, where it is upset by the west wind the barometer begins to rise, and forms the long line of minimum barometer running north and southwards.

25th October? The lowest pressure at Valencia, we presume, would precede that at Eddystone by about as many hours as it was as many fourteen miles to the west of the latter. When we asked Fitzroy about four years ago to examine into this storm, as he will yet see from our letter he has printed in the "Board of Trade Papers," we specially requested of him to do one thing. "Let him trace the atmospheric changes along lines towards the *south-east* and *east* as well as towards the *north-east*. For once let us all take a more enlarged view of the area over which the atmosphere is disturbed in such cases than Dové, Lloyd, and other rotatory theorists have ever done." But we have again been presented with as limited a view of the phenomena almost as that which we could obtain of a large and well-stored room by peeping through its keyhole. The chief use which Fitzroy makes of the facts he has collected is in attempting to make out a whirlwind or cyclone 300 miles in diameter, wheeling and moving along to the north-eastward. Mr. Andrews, in the Board of Trade Papers for 1860, tells us that "the first of the gale was felt at Dunmore, in the west of Ireland, on the 25th." If Fitzroy had ascertained the exact time of lowest barometer there, we could have then seen how long it took to travel to any part of France to the south-eastward, as well as to Lincoln to the north-eastward. But the enormous area over which the disturbed state of the atmosphere occurred on the 25th and 26th is not attempted to be grasped or explained. Espy's generalisations were founded upon observations extending over 25 degrees of latitude, and he confessed that in all probability in winter storms the disturbances to the northwards extended over as many more. He explained the whole, however, on one principle. In most cases, Fitzroy does not deal with the phenomena beyond the limits of the British Islands. But unless you deal with the phenomena over

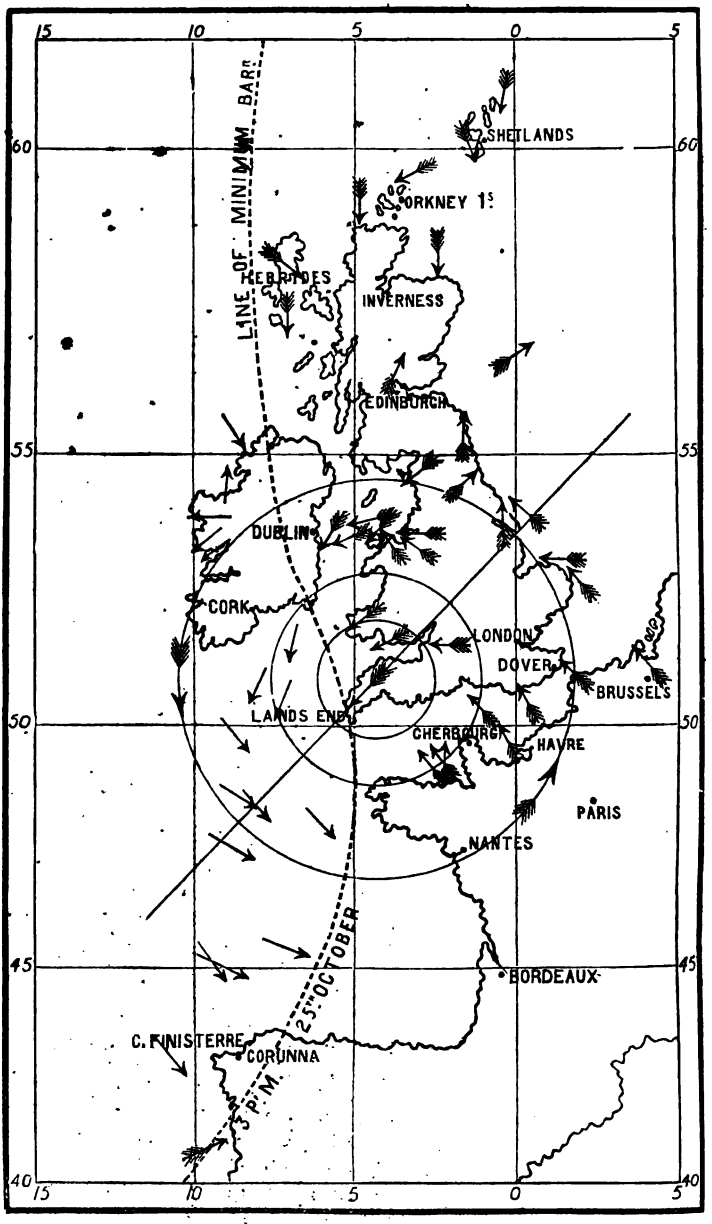
western Europe, a partial and inexplicable array of facts are presented. But thankful for what we have got, let us now follow Fitzroy and point out a few of the legion of difficulties and anomalies to the supposition that there was any cyclone in the Royal Charter storm.

"The central area," says Fitzroy, "of the cyclone *towards* which the winds blew while distant, and *around* when near, was over Cornwall at about three o'clock afternoon of the 25th." But at the very same moment, he is aware, there was also a lull or calm at Eddystone, to the south of Cornwall. Cyclonists used to tell us that the lull or calm only occurred in the vortex or centre, but here we find traces of one running south and north through the supposed whirlwind. We would only ask the reader how it is possible



to have a violent whirling mass of air—say 300 miles in diameter—with a calm or lull right through its centre? This, be it observed, is not an exceptional case, but a characteristic phenomenon in these storms.

The application of the rotatory theory to the facts of the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LINE OF MINIMUM BAR.
SHETLANDS
ORKNEY Is.
HEBRIDES
INVERNESS
EDINBURGH
DUBLIN
CORK
LONDON
DOVER
BRUSSELS
LANDS END
CHERBOURG
HAVRE
PARIS
NANTES
BORDEAUX
C. FINISTERRE
CORUNNA
3 P.M. 25TH OCTOBER

Royal Charter storm is abandoned even by Fitzroy, saving and excepting over some 300 miles of the central area. But Espy has long shown the lull or calm running north and south only occurs within the central area. It is probable that this lull was experienced 150 miles at least to the north and to the south of the centre or lowest barometer. This "lull," though not a "vortex," is occasioned, as Fitzroy observes, "by an apposition of contrary currents of wind." It does not prove that the winds were circuitous, but the very opposite. All the ambiguities of Dové or Herschel pale before the clear light of Espy's reasoning. He says—"*The lull in the central parts may be experienced simultaneously at considerable distances apart, north and south, which could not be the case if the storm were round.*" We only wish Fitzroy would study Espy, and cease to think it any accomplishment in finding "no difficulty in understanding Dové!" According to Espy, all the winds to the eastwards especially of this lull or calm blew obliquely or directly towards it, and, instead of gyrating, ascended *to the top of the atmosphere.* It betrays a complete ignorance on the part of Fitzroy to give out that Espy held "that the meeting of such winds causes a circuitous effect." Having had many opportunities, which were not neglected, of personally discussing all these points with Espy, we ought at least to know what his views were. Any charge of "misquoting" on our part has yet to be substantiated.

We now introduce our reader to the first of Fitzroy's charts, which have been reduced to enable us to explain our views. They are slightly different in their plan of exhibiting the phenomena. The arrows show the direction of the wind as laid down in the Board of Trade Reports. We may here state that the charts were reduced from Fitzroy's larger charts by Mr. Nevin, Lundin Mill School. The arrows were all made naked; we feathered these to the east of the

line of the low barometer to show that they were comparatively moist and warm to those west of this line. In Fitzroy's charts, the lighter or stronger winds were indicated by the length of the black lines showing the direction of the winds; but, owing to the smallness of the charts, this could not be done satisfactorily. We, however, made all the arrows feathered to the east of the "line of minimum barometer," and all naked to the west of that line. That line, it must be observed, is not laid down in Fitzroy's charts at all. As far as we can judge, however, from corresponding facts observed in other storms, the barometer was beginning to rise along this line from Corunna to the Hebrides at three P.M. on the 25th October, 1859. All the winds to the east of that line are in corresponding latitudes comparatively warm and moist to those to the east of it. The southerly winds are everywhere prevailing to the east of the minimum line of barometer either as upper or under currents, which causes the barometer to be depressed over an immense area stretching north and south. All the winds, whether from the N.E., E., or S.E., are merely thin sheets of air deriving their moisture from the south-west current above. The naked arrows, on the other hand, are all varieties or modifications of the cold west or north-west current, which approaches the comparatively moist southerly currents as a broad stream. This broad stream is what is called the anti-trade current, and is the predominating wind in the northern temperate zone. Whether it upsets the warm south-west wind on the Spanish coast, or the wet and snowy north-easters in Scotland, it makes itself felt by lowering the temperature and raising the barometer. The mode in which it acts is shortly explained in the second figure. Near the point of minimum pressure, the west wind is converted into a north or north-west, as it rushes southwards to restore the pressure. In the northern portions, the north-easter, in-

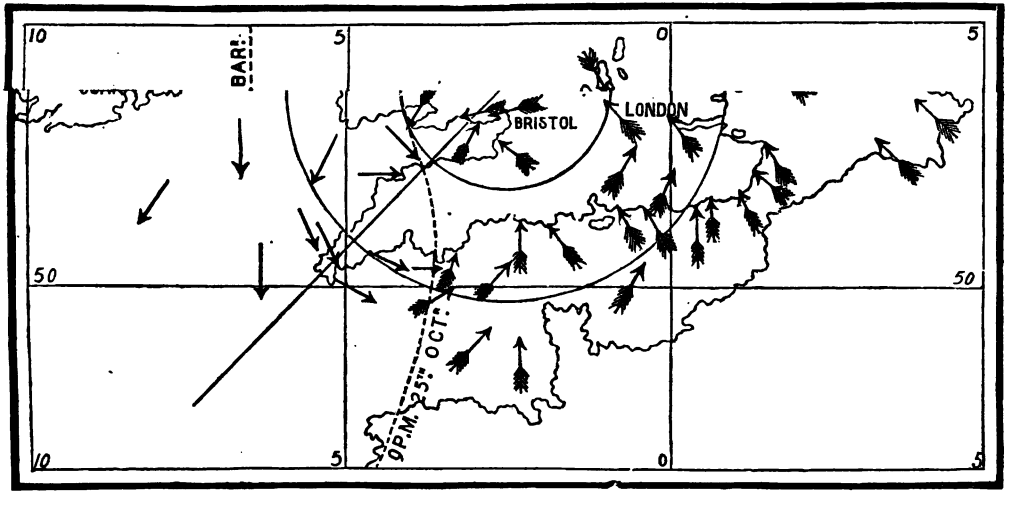
fluenced by the westerly current, and being further from the lowest pressure, gradually loses force and veers slowly round to the west or north-west. This is the reason usually why there is no lull far to the north of the lowest point of the barometer, and also no lull far to the south of it.

It is this southerly tendency of the west wind near the point of minimum pressure which has led astray the rotatory theorists. Had they duly considered the character of the two winds in regard to temperature and moisture, they never would have confounded what Fitzroy calls the dirt-bringing winds and the clearing winds. We have taken the point given by Fitzroy as the centre of his cyclone at 3 P.M., and described a circle. He ought to have done so himself. It will be seen that some of the winds, especially such as those to the westward, so far correspond with the idea of gyrating for reasons already given, near the lowest barometer. But if we look at the arrows west from Cherbourg, the winds are blowing right into the centre of the cyclone. The arrows in the Board of Trade Reports indicate it was blowing a storm from various points north of west from Land's End to Cape Finisterre. These winds are all one current, blowing obliquely or directly towards the line of low barometer. It is simply out of the question to say that they were parts of a cyclone, for the air at this time was not disturbed at Anglesea any more than in Scotland, the air over the latter being almost a dead calm. The arrows to the north of Liverpool only show in Fitzroy's charts that the air was swayed hither and thither by breaths of wind. Fitzroy never attempts to explain the winds in the Bay of Biscay on the cyclonic hypothesis; but if he had placed his centre in the Bay of Biscay, he might have found more arrows to conform to a circle than with a centre over Cornwall. Let it be observed that at 4·15 in the afternoon of the 25th the wind at Highfield, in Nottingham, right in the track of the

supposed cyclone, was N.E., by E., and blowing a brisk breeze. This, it will be observed, was nearly at right angles to the cyclonic direction, forming a radius rather than a tangent to the point of low barometer.

This fifth figure represents the state of the winds at nine P.M. of the 25th. We are now shut out from a view of what was taking place to the south over France. The time when the barometer began to rise there, and the changes in the wind, were not considered by Fitzroy material to the elucidation of phenomena. But even in this chart, limited as our view now is, we still find the arrows in the south-east mostly pointed to the centre of the supposed circling storm, and many of them in its track to Lincoln are again seen to be blowing right through the circle as north-east winds. At 9 P.M. over the south of Scotland the winds were all setting in from the north and north-east, and were blowing a gale with rain and snow before midnight. These rainy north-easters, as formerly said, were overlaid by a southerly current, the same as that which we see blowing as south and south-east winds in the English Channel. Along the supposed track of the cyclone, we repeat, the wind was blowing, not at right angles or tangents, but towards it, more like radii.

Our approximate line of minimum barometer merely shows the progress that the west wind is everywhere making north and south in driving away the warm southerly current. Wherever the west wind reaches it the sky soon clears, the temperature is reduced, and the barometer rises. But, like the easterly winds which preceded the westerly, it is converted into a more northerly wind the nearer it is the point of lowest barometer.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9 P.M. 25th OCT.
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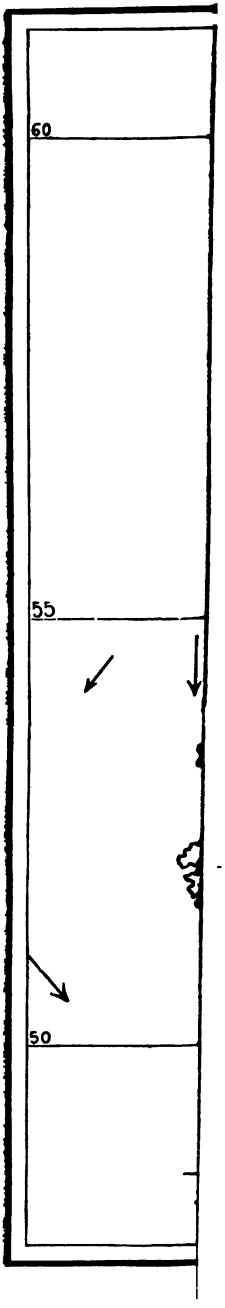
principles we have laid down. It is only to the character of the winds at 9 A.M. of the 26th that Admiral Fitzroy points (see *Weather Book*, page 300) to show that the winds were really circuitous over a limited area. No doubt they have some resemblance, as they often have, to such a figure. But what trampling-under-foot of plain and well-established facts does such a hypothesis involve? All the southerly and easterly winds, for example, to the east of the dotted line, from Shetland to Belgium, are comparatively warm and moist; and all the westerly winds to the west of this line are dry and cold. Could any one render us a plain reason why there should be a reduction of temperature in the easterly winds as soon as they sweep round and blow as northerly winds? Our cyclonists would make us believe that rude "Boreas" and the "foggy south" are one and the same wind gyrating round and round a common centre! Besides, as Espy has pointed out, how can winds of such opposite characters possibly gyrate when there is usually a calm or lull *extending north and south right through the centre of these supposed whirlwinds.* Whatever is the explanation of the facts, it must be found in some hypothesis other than that of whirlwinds.

If Admiral Fitzroy had given us the directions of the wind over France, we could then have seen the action of the westerly wind lowering the temperature from Spain to the Hebrides. These great barometrical fluctuations affect the whole of Western Europe, and all the facts must be comprehended and dealt with in any explanation of their nature. Of late years, such facts as do not square with cyclonic notions have been left out of sight, or regarded as "worse than useless." The cyclone or whirlwind of the Royal Charter storm, we are now informed, was only some 300 miles in diameter. The north-east wind set in in the Frith of Forth at sunset of the 25th, and was then blowing almost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right to the centre of the supposed cyclone. It did not change its direction for eighteen hours at least; and surely it is utterly preposterous to assert that it was part of a whirl-wind at its termination, when it is admitted by Admiral Fitzroy himself it was not so at the commencement.

On looking back to the first charts in the *Farmer* of 17th August, the progress which the cold west wind is making will be readily seen by observing the line of minimum barometer. The largely convexed line at 9 A.M. of the 26th merely shows that the west wind had been advancing faster in the English Channel than over Scotland. Its influence seems to have been felt at Brussels about the same time as it was at Glasgow, the barometer rising at both places about the same time. On the night of the 26th, the wind was north-west over the whole of Scotland. The west wind, then, had cleared the whole island of the remnants of the southerly upper currents which had supplied moisture for the great rain and snow-storm that prevailed over the country. This storm is only another striking illustration of the views we put forth seven years ago. "The winds may all be regarded as modifications of the *south* and of the *west winds*. The modifications of the *south wind* are north-east, east, south-east, and south-west, which, after blowing for some time, are characterised by a rising temperature and falling barometer. The modifications of the *west wind* are the north-west and north, which are characterised by a low temperature and high barometer." These two distinctive winds are "the opposing currents" of Admiral Fitzroy; and instead of being nearly "parallel currents," which he writes so much about, the one, *the west wind*, blows nearly at right angles to the other, *the south*, or south-west. But more on this point immediately.

Admiral Fitzroy is exceedingly displeased with us for having written some sharp criticisms on Dové's ill-defined

and ever-changing views. Now, we shall just devote this paragraph in vindication of ourselves. Admiral Fitzroy is still much in love with Dové's parallel current theory (the nature of which we have already described). He has even patched up this theory (as has also been shown) by adding "lateral translation theory." But Dové has so far thrown this theory aside." In the Board of Trade Papers for 1858, edited by Fitzroy, Dové says (page 13):—"At the time I published my first works on the winds, I ascribed the *law of rotation*, as well as the circling motion of storms, to the counter-operation of two aerial currents rushing towards each other in lateral directions. A closer examination of the phenomena convinced me, however, that the *law of gyration* is based on general conditions, and that it is a simple and necessary consequence of the rotation of the earth." Is Admiral Fitzroy not aware that he still advocates these renounced ideas of Dové in his Report of 1864? Along with Admiral Fitzroy, nine-tenths of cyclonic writers explain the action of storms on Dové's old cast-off theory. Thus, though a mere "amateur," we are glad we never were a disciple of Dové. Sir J. Herschel has his own views of this new "law of gyration;" but, unhappily either for himself or for Dové, he says that certain phenomena cannot occur which Dové tells us frequently occur. But an amusing instance of distrusting this authority occurs in the *Weather Book*, at page 215. Admiral Fitzroy is there sadly discomposed at what he considers certain new meteorological heresies on the part of Dové in "his *latest* work, only just translated and published." His only consolation is in trusting "that his highly-esteemed friend will re-consider the subject." We hope the advice which is given will also be taken by the party who gives it. These latest views of Dové are only certain of those which we have applied to the action of the north-west winds in our great storms for the last fifteen

years. What are the new views which have for once sundered Dové and Admiral Fitzroy? Here they are—"The polar current advances along the earth's surface and the other (the equatorial) approaches first from above." In other words (which applies to the north-east winds in all our great rainy storms), the equatorial or south-west winds bring up the clouds and the rains; and the north-east wind merely flows in below, like the sea-breeze on our coasts in summer. Let us tell Admiral Fitzroy that he might have detected this same heresy in the *Board of Trade Report for* 1858, in which he publishes and edits Dové's "authoritative work;" but we suppose he was then too much in love with cyclones and "laws of gyration" to notice it, and warn the reader of its unsoundness. These few grains of truth in Dové's essay are to be found at page 68 of the *Board of Trade Report for* 1858. It is just about a dozen of years since Dové laid it down as a great law that in the tropics the winds are superimposed the one above the other, and that in the temperate zones they flow side by side, or in parallel currents. Yet Dové never imagined that the parallel currents had often, according to Fitzroy, a rapid lateral translation. What we say is, Dové's writings on the science of meteorology are as full of confusions and inconsistencies as are those of all his admiring followers.

At the Royal Observatory, Greenwich, the winds during the Royal Charter storm veered from E.S.E., S.E., S.S.E., S., S.S.W., S.W., to W.S.W. The winds at Highfield Observatory, Nottingham, over which the centre of the cyclone was supposed to have passed, veered from N.E. by E., through E.N.E., E. by N., E., E.S.E., S.E., S., S.W., to W. It is plain that these directions at both places were not tangents to any whirlwind storm travelling from Cornwall. Not being conformable to a circle, they cannot be explained on the rotatory theory. The true explanation of

these veerings is that a south-west or equatorial current prevailed above. Owing to the mass of cold air, it could not, as Dové says, "first approach the earth," but so long as it continued above, it gradually heated the air below, and gradually drew the winds round until upper and lower currents coincided. As soon as the *west* wind set in, however, the temperature descended at Nottingham, just as it did when the westerly wind set in at the same time on the west of Scotland.

The wind in all its veerings north and south in the Royal Charter storm blew from a high towards a low barometer. The low barometer shifts its place, and the winds veer round as they attempt to reach it. They do not blow to a common centre, but, like the heavenly bodies under the law of gravitation, the force of their mutual attractions is inversely as the distance. A quarter of an inch depression in the barometer at the distance of twenty miles will have a much greater drawing or propelling power to the air than an inch depression at 200 miles. It is this principle which deprives the winds during storms of that symmetrical form or system that some are always looking for. The phenomena must be dealt with separately as well as viewed as a whole, and then we perceive the order that reigns throughout.

The great north-easterly rain storms that have recently deluged Scotland with an unprecedented quantity of rain may be shortly sketched as illustrating the same views which apply to the Royal Charter storm. On the west coast of Scotland, on Wednesday the 19th, rain began to fall about 7 A.M, from clouds drifting from the south-west. A breeze from the north-east, as a thin sheet of air, had set in an hour before. This north-easterly current was never throughout the day of any great depth—little over, we should think, 3000 feet. The rain was two hours longer in beginning to

fall on the east coast. The air rushed in fast from the north-east all day, and kept the temperature low; but about midnight the easterly wind ceased. There was then a lull and a calm, and the south-west upper current approached the earth's surface. There was then no ascending current, the rain ceased, and a great rise of temperature was observed at Leith. At Highfield, Notts, the temperature rose about midnight to 62 degrees. The temperature fell everywhere, however, when the west or north-west current made itself felt. Again, Friday, the 21st, was a lovely day all north of the Frith of Forth—a remnant of the influence of the north-west wind. But in the forenoon a thin but equally diffused stratum of cloud hung over the whole southern horizon. This was the most northern trace of the wet and dirty weather that prevailed over England. The nature of this cloudiness was soon made known. By mid-day thin streaks of cloud made their appearance north of the Forth. These were drifting rapidly from the south of west. Before sunset they had covered almost the whole heavens with a thick veil. The north-east wind again set in, and it blew at first gently from a clear speck in the north-eastern horizon. It increased in strength as the cloud above thickened, and broke out into a tempest as soon as the rain began to fall. The north-easter was much deeper than on Wednesday the 19th. It blew with violence and continuous rain for fifty hours, and the temperature all the time did not vary much from 42 degrees. The upper south-west rain-bearing current did not reach the earth, and there was no rise of temperature. The wind veered to north and fell along with the temperature, when the barometer began to rise under the influence of the north-west current, which cleared the sky and again brought back beautiful weather.

One of the prime errors which runs through all the writings of Dové and Admiral Fitzroy is in their not com-

prehending the nature of our cold or northern winds. Much they write about polar currents, and insist that a great preponderance of these *should*, owing to the earth's rotation, be north-east winds. But, as Humboldt pointed out more than half-a-century ago, theory and practice do not square well on this matter. The fact is, instead of our cold and dry winds having a due north origin, they have a west, or north-by-west origin. The north-west is the great current that cools the air and raises the barometer throughout America, as well as Europe. The due north winds that are found on the western sides of storms are comparatively local, and all propagated from the north-west, which overrules and overbears all the northers. The due north winds have their origin in local adjustings of pressure in the great western current that sweeps the whole of Europe. Upon what other hypothesis can we account for the fact that the barometer began to rise about the same hours nearly on the same meridian over the whole of Europe in the great storm of February, 1856. Yet that storm was said to have a north-easterly progression. The storm of December, 1863, has been examined by several individuals. Admiral Fitzroy, tracing it to the north-east, imagined that its progression was in that direction; others examining it found that it had a south-east direction. Marie Davy, of the Paris observatory, as well as Mr. Buchan, the able secretary of the Scottish Meteorological Society, both arrived at the conclusion that it travelled from the north-west over Britain. This, as we showed in a former number, is easily explained. As in the Royal Charter storm, Admiral Fitzroy's analysis of this is incomplete by leaving out of view almost one-half of the storm-region in his charts (*Report*, 1864). Not looking for facts in the South of Europe, he could not find it there. "Some observers," he says, "thought that one and the same storm traversed Europe

from Ireland to Rome." This is but the old story of making the observations of others "worse than useless;" for he sets them all aside by adding, "such a view requires the progress of that storm to have been from the north-west toward the south-east, which our charts show did *not* occur." One great fact Mr. Buchan discovered which entirely bears out our view, that the barometer attained its minimum on the 15th degree of longitude about the same hour in Italy as it did in the Baltic. This conclusively shows that the storm had a course from almost due west to east, and travelled faster along the south than the north, inasmuch as the degrees of longitude are broader on the south.

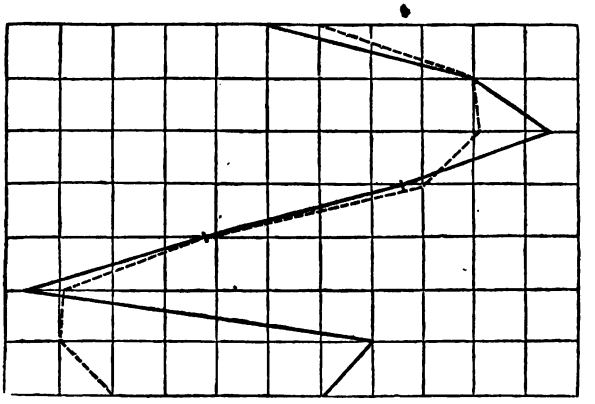
Reid and Redfield had so much faith in the rotatory theory as not to hesitate in asserting that whirlwind storms often embraced the whole or greater part of Europe. The simultaneous rise of the barometer in the south and in the north of Europe was by them ascribed to cyclones being of enormous dimensions. But on this subject once more a startling change of opinion comes over Admiral Fitzroy, after having got a glimpse of the area of atmospheric disturbances in the storm of December, 1863. He, in his *Report* for 1864, seems at last awakened to the utter absurdity of applying the cyclonic theory in such cases. He treats the "integrity" of the once gallant cyclonic theory with supreme ridicule. The italics and marks of astonishment are his own; but let us tell him they are directed as much against his own opinions in his former Reports, as to those of Dové and to those of the "legion" (as he terms them) of rotatory theorists. Was the rotatory theory ever subjected by its enemies to such sarcasm? Referring to the facts collected in the storm of December, 1863, he writes:—"These effects were not due to one *travelling* cyclone (*monstrum horrendum!*)—they were results of two great atmospheric impulses—*seemingly*, not *truly*, waves, but rather

as it were pulsations from opposite directions, breasting each other in mutual opposition!" This we will only add is a fine specimen of ambiguous and unmeaning writing—a natural consequence of being considerably at sea on the whole subject.

Dové, in *Board of Trade Report* for 1858, asserted (page 8, see also chart 1) that the phenomena of the great storm of December, 1821, could "easily be explained," and he did explain it by the passage of a *monstrum horrendum* cyclone, embracing in its ample gyres the whole of Europe. We are glad to find that in his letter to Admiral Fitzroy in *Report* for 1864 he is now not finding facts fitting in so easily. After examining another winter storm, he writes, "I have encountered great difficulties. . . . It appears to me very difficult to ascertain in a given case, with precision, if the direction of the vane indicates the tangents of a whirlwind, properly called, or the mere direction of a current." This confession is not very assuring to those who impose implicit faith in his theorisings.

As frequently urged, the *fall* of the barometer in the first part of all the great winter storms that sweep the continent of Europe is to be ascribed to the flow of the south wind either as an under or upper current. The warmer and lighter stream causes the barometer to fall. On the other hand, the simultaneous *rise* of the barometer on the meridians, at great distances apart, is to be ascribed to the west or north-west wind taking the place of the south wind, as we have already described in this series of papers. This colder and heavier stream causes the barometer to rise. The height of the barometer, therefore, is inversely as the temperature. These principles may be illustrated by exhibiting this intimate connection of temperature and pressure—the state of the barometer and thermometer at Kalouga, in Russia, during the passage of the storm of February,

1856. The dotted lines show the temperature in centigrade degrees, the black lines the pressure. Temperature of the air might surely change the pressure; but could any one, except a wave-theorist, believe that either "breastings," "impulses," "waves," or "pulsations" of the air could impart or create heat and moisture. Out of the south cometh heat, and out of the north-west cometh cold. This is the simple outline of our explanation of European storms.



This diagram, when rightly viewed, is sufficient to refute Admiral Fitzroy's dictum that "the highest barometer and lowest temperature are almost midway in the polar current —the lowest or least tension, with the warmest air, being near the middle of each tropical current." The lowest tension, say we, and highest temperature occur on the *western edge* of the equatorial currents, and forms the line of minimum barometer. The polar current is a north-wester, and its first effects are gradual, like the entrance of a wedge —the temperature falls and the barometer continues to rise as long as it blows. Properly speaking, the edges of the

polar current are found in the north and in the south of Europe. This current flows not parallel to the equatorial, but nearly at right angles. Will Admiral Fitzroy discuss this point with us?

Professor Airy, the Astronomer-Royal, tells us he has always looked upon the evidence of storms being of a rotatory character as "meagre." Surely, if Admiral Fitzroy would just bethink himself, he would see the folly of always thrusting Dové as an authority upon us and others. In regard to the famous parallel current theory, pure and simple, its author thought it explained everything. But Admiral Fitzroy found it necessary to add the incomprehensible notion of a "lateral translation" of the two currents. So we may well say the evidence adduced by Dové in explanation of the phenomena of storms must certainly, if Admiral Fitzroy be right, have been of a most "meagre" character indeed.

The Reports of the Board of Trade, whether the earliest or the latest, teem with matter which might be criticised, but we suppose we have done enough. We have been accused by Admiral Fitzroy in the *Times* and in his "Reports" of "misquoting" Espy, but we will only say Espy never accused us of this, and he knew our views far better than Admiral Fitzroy seems to do. We could point to some passages in Admiral Fitzroy's papers, which Espy would never have sat under had he been alive. But since Admiral Fitzroy uses such liberties with one who cannot defend himself, we shall give our readers the "lamented Espy's" estimate of his expectations of what would be done for the *science* of meteorology by the head of the Meteorological Department of the Board of Trade. In 1859, Espy wrote—and we agree with every word of it—"I fear Captain Fitzroy will not do much for the science of meteorology. He is deficient in the elements. On the subject of vapour in the

air he is entirely befogged; *and yet I believe he is in search of the truth.*" We will only add, believe it who likes, that discussing the phenomena of storms with one who has not studied Dalton unnerves us for such a contest.

We shall be glad to answer, to the best of our ability, any question that may be put to us by Admiral Fitzroy or others in plain and intelligible language. Any point to which any one wishes to direct our attention, we will be happy to enter upon. We have been accused of "dogmatism" in freely stating our convictions, for which at least we are always ready to render plain and simple reasons. Right or wrong, our mind on the great outlines of the phenomena of storms has gone through that humiliating and self-abusing process so well and so eloquently described by Bacon:—"The human mind is often so awkward and ill-regulated in the career of discovery, that it is *at first diffident* and *then despises itself.* For it appears at first incredible that any such discovery should be made, and after it has been made it appears incredible that it should so long have escaped men's research." Yes, all truths are contemptibly simple; and when once fully realised they are despised, and thrown aside like an old garment.

But it will be asked, how can Admiral Fitzroy do so much good as he is doing in forecasting storms, if he is so far wrong in matters of theory? Were the labours of the ancient astronomers, we ask, worthless at a time when they took it for granted that the sun moved and the earth stood still? The old astronomical theory explained the majority of phenomena as well as the new and the true theory. So it is in some measure with forecasting the weather. Storms may be roughly forecasted whether we believe them to pertain to the *monstrum horrendum* character of single cyclones, or even in consisting of "waves," "pulsations," or "breastings." If certain phenomena are described by

obscure terms, so much the more oracular and wonderful does forecasting appear when a storm actually follows.

A gentleman, whose business and duty it is to study meteorological questions, told us the other day that he had read the *Weather Book* attentively in trying to ascertain the principles upon which Admiral Fitzroy makes his forecasts, but had entirely failed in doing so. It was just the other day, also, that Admiral Fitzroy, in the *Times*, again attempted to explain his system of forecasts; but "what was dark enough before was made far darker." The outlines of forecasting storms by telegraph is of a most simple description. Any of the different theories that ever were proposed might so far serve the purpose. This we shall illustrate in our next by reference to the telegraphic warnings sent to Edinburgh of the two great rain storms of last month.

No. VI.

We have always carefully avoided speaking slightingly of the system of storm warnings which Admiral Fitzroy has established. We consider them, imperfect as they are, well worth all the money expended in carrying them out. It was long before sailors or fishermen at a port would place much faith in the slow and silent movements of the mercury sinking in the barometer. In some places, however, this state of things is greatly changed, and the fluctuations of the mercury are now regularly consulted before boats are put to sea. This has been mainly owing to the labours of Admiral Fitzroy. The "hoisting of the drum" by telegraphic communication has, through the results of the last three years' experience, taught part of our seafaring population the value of meteorological science. The practical fruits of the system

are already so far realised. The confidence of those who are most deeply interested in storm warnings has been gained. At the same time, however, we have long felt that Admiral Fitzroy makes, alike for practical and scientific purposes, by far too much mystery of his craft of forewarning storms. Those who read his *Weather Book* are made no wiser as to the simple principles upon which he must found his forecasts. One of his foreign correspondents, as the Report for 1864 bears evidence, has sought in vain to obtain a single practical hint. Signor Matteucci, of Turin, who is establishing a system of storm-warnings for the Italian Government, thus anxiously, in his letter to Admiral Fitzroy of 15th February, 1864, pleads:—

"Let us put aside the theory and great principles of meteorology, which are, I believe, of very little value yet—the heat of the equator, the cold of the pole, the rotation of the earth—this is very old, and was not sufficient to establish a system of practical meteorology. As to myself, I never (tried?) to understand the wonderful discoveries of our colleague, Dové. Let us speak according to the English fashion—that is to say, of things practical, and proved by a great number of observations. Having charge of organising this service in Italy, I will walk step by step, and with great modesty. . . . Give me only results best established independent of all theory." *

This is what many have asked in other words in this country. The answers are invariably such as is here complained of—a reference to what everybody knows, the heat

* The following is the part of Matteucci's letter of which we have given a translation:—"Laissons de côté la théorie et les grands principes de la météorologie qui sont, je crois, bien peu de chose encore—la chaleur de l'équateur, le froid du pôle, la rotation de la terre—cela est vieux et n'a pas suffi à fondre la météorologie pratique. Quant à moi je n'ai jamais (essayé?) de comprendre les grands

of the equator, the cold of the poles, etc., to the works of Dové, and to the *Weather Book*. But the best established facts upon which forecasts can be founded "independent of all theory" are not to be found in the published works of either Dové or Admiral Fitzroy. Let us, therefore, in endeavouring to present those facts which have been best established, throw theory aside as far as possible.

In 1857, years before Fitzroy commenced his forecasts, we wrote:—"At the present time, we have no means of anticipating the approach of some of the *winter* storms of Britain beyond twelve hours before they burst upon our coasts; but as soon as the telegraph is laid down across the Atlantic, it is probable that the sudden irruptions of our high winds in *winter* may be known for three days or more before they occur." This was written after we had presented evidence that some of the *winter* storms of Britain were merely part of a vast system of atmospheric disturbances that were propagated from nearly due west to east across the Atlantic and over the continent of Europe. The rate of progression or propagation is sometimes about forty miles an hour. As Valentia is about 400 miles to the west of London, the fall of the barometer on a storm travelling at forty miles an hour might, by the aid of the telegraph between the two places, be forecasted in London ten hours before it arrives. Owing to the enormous area over which our winter storms extend, if Iceland were connected by telegraph with Edinburgh or London, storms might often be sooner anticipated from that quarter, simply because that island lies farther to the west than any station on the west

découvertes de notre collegue, M. Dové Parlons à l'Anglaise—c'est-a-dire, de choses pratiques et prouvées par un grand nombre d'observations. Chargé d'organiser ce service en Italie, je veux marcher pas à pas et très modestement. . . . Ne me donner que les resultats les mieux établis indépendammant de toute theorie."

coast of Ireland. Besides, the disturbed area, as indicated by the long line of minimum barometer running north and south, often travels a little in advance of the meridian in the northern parts of the storm. In consequence of these facts, many of our winter storms commence quite as soon at Edinburgh as at Valentia, which is further to the west. For these various reasons, nine-tenths of our rapidly-moving winter storms have already set in at Edinburgh before the telegraphic warnings arrive. But, as has long been known, our winter storms seldom travel singly; they often follow in a train, just as they did at periods of barometric depression during the last two months—October and November—at intervals of about two days. Thus, it sometimes happens that the telegram or signal at an out station arriving too late for the storm it was intended to announce is allowed to stand till the next one arrives, but for which it was not intended. The general public frequently fall into this last mistake—a circumstance which has tended not a little to confirm them in the belief that storms can be forecasted for days before they arrive. We cannot do so. We are too close upon the Atlantic, which to us is the "cave of the winds," out of which all our storms issue, and afterwards travel so fast towards the east. Out of nine telegraphic warnings sent to Edinburgh in October and November, only one of them arrived before the storm began, and one of the warnings, for reasons given below, was a mistake, no storm occurring.

It must be kept in mind—what we have insisted on for the last ten years—that the season of the year changes some of the features or developments of storms. So much is this the case, that Espy did not generalise on the American storms during the warmer season. We hold, however, that the distinguishing features of the storms during the warmer months consist in this: that they usually travel from west

to east at a much slower rate than during the colder months. Thus, the storm of February, 1856, had a rate of progression over Britain of about forty miles an hour; while the Royal Charter storm of October, 1859, had only a rate of about fourteen miles an hour. While the former storm, therefore, could have been anticipated in London only ten hours beforehand, the latter might have been nearly thirty hours.

We shall illustrate our views by the facts which the rain storms of October and November afford. We all know that the barometer and the weather were remarkably steady during the first half of October. On Monday, the 17th October, however, the barometer pointed to disturbances, for, according to the *Board of Trade Reports*, it stood at Valentia 29·67, at Leith at 29·31. The barometer being thus higher at Valentia, there is no difficulty in understanding why we should have had south-west winds in Scotland. No rain fell on the east coast of Scotland; but on the west coast and in the Highlands great quantities fell. Was it not the high pressure in the south compared with the north that was the chief datum for the telegram that arrived at Edinburgh on Monday afternoon from the Board of Trade to "hoist drum!" In Scotland, all south of Nairn, where the barometer stood at 29·20, the winds were from the south-west. They were blowing from a high towards a low barometer. But it must be kept in mind that the wind was blowing or the rain falling long before the telegram or forecast arrived.

On Tuesday the 18th, the wind went to the north of west in the afternoon, with a slightly rising barometer. This was the termination of the first disturbance. At eight A.M. of Tuesday the 18th, the barometer stood, according to the *Board of Trade Returns*, at Valentia, at 29·61 inches; Ardrossan, at 29·42 inches; Leith, at 29·37 inches. The barometric pressure being still greater in the west, so, as

might have been expected, the wind was from the west at Leith. At that hour, it is seen that the barometer was 5-100ths of an inch higher at Ardrossan, in Ayr, than at Leith. At eight in the morning of Wednesday, the 19th October, a striking change, however, had occurred in the relative heights of the barometer at Leith and at Valentia. The barometer then stood at Valentia at 29·03; Ardrossan, at 29·29; Leith, at 29·46 (?). The pressure being now greater in the east, there is surely no difficulty in understanding why the air should tend or be driven towards the west, and form an easterly gale in the Frith of Forth on the 19th. The difference in the pressure at this time between Leith and Ardrossan is very remarkable, so much so that a mark of distrust was put to the figures at Leith.

The storm of the 19th October seems to have eluded the vigilance of Admiral Fitzroy, for we had no warning of its approach. He seems to have contented himself with casting doubt upon the indications of the barometer at Leith. The gale and rain, however, that occurred showed there was no mistake in the readings. This may explain why the storm that raged during the night of the 21st, throughout the 22nd, and part of 23rd, was duly attended to, and did not come upon us without ample warning both before and after it had begun.

So again, on Friday the 21st October, a telegram arrived at Edinburgh from the Board of Trade—"Hoist the north cone;" indicating that "a gale is probable from the northward." This was a genuine forecast; for Friday, though ominous of change, was a beautiful day, all north of the Frith of Forth. The difference in the barometric pressure on the west coast of Ireland and in Scotland was such as to indicate very plainly that the calm weather would not last long. Were the following figures not the secret clue to the telegram on the 21st? At 8 A.M. the barometer stood at

Valentia, at 29·16; Ardrossan, at 29·63; Leith, at 29·63. At this hour the air was so equally balanced at the northerly stations that it was completely calmed down, and hoar frost was strewed over the whole country north of the Forth. This cold body of air was ready to be propelled westwards as soon as the clouds in the south-west upper current were condensed into rain. This happened in the north after sunset, and the gale came on from N.E., or nearly the same quarter as it did on Wednesday morning the 19th.

Once more, a telegram arrives at Edinburgh about noon of Saturday, the 22nd, "Hoist Drum;" but in this case the gale had been blowing for fifteen hours before the telegram arrived. At eight A.M. on Saturday, the differences in the barometers at our selected stations are repeated within a few hundredths of an inch to those existing on Wednesday morning—Valentia, at 29·06; Ardrossan, at 29·28; Leith, at 29·41. Why, we ask, should Admiral Fitzroy have appended a mark of distrust to the Leith observation on the Wednesday, and not on the Saturday? The great difference in the pressure, for so short a distance as that between Leith and Ardrossan, again readily explains the cause of the fury of the easterly gale in the Frith of Forth, with the wrecks at Granton on Saturday the 22nd.

To show the enormous area over which such storms extend, we may mention that the wind from the east with rain commenced on the 19th in Orkney about mid-day, some four hours before it began at Nairn. This so far indicates that it *first* developed itself in the west. But complete proof of the entire atmospheric disturbance having a progression from nearly due *west* to *east* is furnished by observations at the Liverpool Observatory and at Highfield Observatory in Notts. The barometer attained its minimum at Liverpool at 10·40 P.M. of the 19th, and at Highfield at 2 A.M. of the 20th. Highfield is to the south-east of Liverpool, and the

distance apart is about 100 miles; this shows that the storm, as measured by the minimum barometer, travelled over that part of England at the rate of somewhere between 25 and 30 miles an hour. The barometer began to rise at Sandwick, in Orkney, at 1 P.M. of the 20th; within an hour of the same time as at Aberdeen. As in the Royal Charter storm, the *line of minimum barometer* was largely curved "with its convex side towards the east." Yet our Astronomer-Royal for Scotland describes the whole phenomena on the hypothesis of their being parts of such a *monstrum horrendum* cyclone, as is now too much of a good thing even for Admiral Fitzroy. He says:—"From the French meteorological maps, it appears that the storm, as felt here, was only the northern part of a grand cyclonic disturbance, which had its centre in the latitude of the British Channel, and caused winds in France chiefly S.W. and S." The S.W. and S. winds in France made themselves felt in Scotland as upper currents, which supplied the east winds with moisture, and caused the barometer to fall from the Mediterranean far beyond the Orkney Islands. We only add, however nearly the winds at various stations might resemble a vast whirlwind, two facts which might be pretty clearly brought out would still show that such a supposition involved physical absurdities—1st, We think it will be found that a calm or lull extended from Highfield in Nottingham at 2 A.M. of the 20th right northwards as far as Edinburgh, forming neutral ground, which the easterly and westerly winds respected; 2d, If the storm travelled from west to east, a north-easter should in no case have ushered in the war of elements; 3d, A full examination of any one of the storms during the last two months would show that the area of depression of the barometer was three to four times of greater length than breadth. The simple explanation of the veerings of the wind is, in the north of Scotland the north-easters swung

round against the sun and became north-westers in consequence of the *minimum point of barometer* crossing a more southerly parallel of latitude. For corresponding reasons, the S. and S.E. winds in France and in the south of England veered round to the south-west with the sun.

The simple principles of forecasting storms may be further illustrated by the storms and depressions of the barometer during November. In Wigtownshire, "the wind came on to blow strongly from S.S.E. on the 12th, and continued to do so the whole of the night. On the morning of the 13th, the gale increased to a heavy storm, with rain falling thickly." The rain did not begin to fall, and then only slightly, on the east coast till after mid-day of the 13th, when dense clouds came up from the south-west, against a strong easterly wind. At 8 A.M. of the 11th, there was only a difference of one-tenth of an inch of pressure between Valentia and Leith; but at 8 A.M. of the 12th it amounted to rather more than one-third of a inch, being less at the former station. The barometer seems to have continued falling rapidly at Valentia, for by 5·15 P.M. a telegram arrived in Edinburgh, "Hoist drum." But the wind, in this instance, had been blowing for twelve hours before it arrived. An unequal pressure still existed on the morning of Monday, the 14th, between the west coast of Ireland and the east coast of Scotland, so another telegram arrived to "Hoist the drum;" but the wind had been blowing pretty strongly and steadily from the S.S.E. for 48 hours before it arrived. Again, the 16th of November was a beautiful day, there being apparently a truce among the elements. At 8 A.M. there was only a difference of 6-100ths inch of mercury between Queenstown and Leith; but the barometer must have been sinking at Queenstown in the afternoon; for early next morning the wind and rain suddenly began afresh in Edinburgh, with a rapidly falling barometer. At 8 A.M.

on Thursday, the 17th, the barometer had sunk on the west coast of Ireland nearly (8-10ths) eight-tenths of an inch of mercury within the 24 hours, and at Leith only (14-100ths) fourteen-hundredths. This shows that the barometer had begun to sink much sooner in the south-west and in the west than at Leith. This state of things formed the chief element for the forecast (?) that arrived in Edinburgh on *Thursday afternoon* to "Hoist drum;" but the elemental warfare had commenced six hours previously. What we say is, if our coast station-masters at Leith and other places wish to make real or genuine forecasts of coming changes of weather, they must have two-hourly telegrams sent directly from the west coast of Ireland, and compare these with their own barometers. The sudden change of weather at Edinburgh on Thursday morning, the 17th ult., we repeat, could only have been anticipated on the fine afternoon of Wednesday by having had a telegram of the state of the barometer transmitted directly from the west coast of Ireland.

As further showing the principles upon which storm-warnings in Britain ought to be founded, the facts connected with the great gale that raged on the east coast on Thursday, the 24th ult., from Suffolk to Forfarshire, and was attended with such disastrous consequences to shipping, may be adverted to. On Tuesday, the 22nd, a telegram from the Board of Trade arrived, warning us here of a "gale, probably from the southward." This forecast was made out of the observations transmitted from all parts of the country to London as at eight that morning. *Now, this forecast was out and out a complete mistake.* Instead of a gale from the south, the little wind we had that day was from the north; and it may be said it was from the northward till mid-day on Thursday. A cursory glance at the collected observations of Tuesday morning is sufficient to show that a "gale from the southward" at Edinburgh on Tuesday was

little else than a physical impossibility. The barometer stood slightly higher at Nairn (29·45) and Aberdeen (29·44) than at Leith (29·41), Ardrossan (29·36), and at Greencastle (29·36), in the north of Ireland. The slightly greater pressure at the northern stations was strikingly consistent with the very light wind we had from the north after midday. One grave fault we find with our present system of weather telegrams, and we take two instances to point it out. Admiral Fitzroy pretends to forecast the particular directions of the wind over Britain some sixty hours beforehand. This he does every day in the *Times*. Now, we assert, for reasons already given, that he can no more do this, within the veriest bounds of probability, than M. Matthieu (de la Drôme) can forecast the character of the weather for months beforehand. As the results of consulting the observations of Tuesday morning, he gave us to understand it was probable the weather on the east coast of England on Thursday, the 24th, would be "Wind S.W. to N.W., strong to moderate;" and while rain was to fall in all other places, none was put down for these parts. The station-masters, therefore, on the east coast, who may have consulted the forecasts in the *Times* of Wednesday, must have been put off their guard, for a dreadful easterly gale, with rain, prevailed on the east coast of England from an early hour on Thursday morning till Friday morning. So far as we are aware, the gale on the east coast was confined to that area over which the rain was falling so abundantly. The wind did not begin to blow with any strength in the north till the rain began to fall. At 6 A.M. on Thursday there was a sharp frost north of the Forth. But shortly after that hour cirro-cumulus clouds were seen crossing over the moon from the south-west. It was these clouds that brought up the moisture, and the north-east wind, which afterwards blew so strong, was only a comparatively shallow

surface-current. The storm of Thursday eluded the vigilance of Admiral Fitzroy, and came upon the east coast of England without warning, or rather they were told there would be no rain or storm. It was evidently propagated rapidly from the west of Ireland; and there is little probability that it could have been forecasted with any certainty more than 15 hours beforehand. The barometric readings, again, told a curious and interesting tale on Thursday morning. There was only a difference of pressure between Leith (29·49) and Ardrossan (29·47) of 2-100ths of an inch. We need not wonder, therefore, that the easterly gale on the east coast here was so quickly checked in its career towards the west. It did not reach the west coast, being, like the summer sea-breeze, doubled up and swept back by the upper south-west current. There was a check to the descent of the barometer early on Friday morning, the wind having gone into the north-west; but it again began to fall here with a strong southerly breeze by mid-day, so that the gale had commenced before the telegram arrived same day at 12·46, warning us of winds "from nearly opposite quarters successively." Another telegram arrived on Monday, the 28th ult., about noon, to look for a "gale, probably from the southward;" but we may all recollect that the storm began on Sunday night, and that the wind had gone to the north of west and abated before this telegram arrived. What made Admiral Fitzroy so far behind on this occasion was there being no telegrams on Sunday. In this instance, he mistook the going off of the storm for its coming on. He might have seen from his weather reports on Monday morning that *a line of minimum barometer* extended from somewhere near Nairn southwards by Ardrossan, Holyhead, down through St. George's Channel. Everywhere to the west of this line the wind was lulling or abating, and changing into the west and north-west. The cautionary signals sent to all the west

coast stations were a day too late. From the character of this gale, we do not think that it was possible to have had more than eight hours' notice of its approach by telegram. The barometer scarcely began to fall here before the wind and rain commenced, a peculiarity of a certain class of storms which we have pointed out more than ten years ago. Nor was the calm fine weather on Sunday, the 27th, at all consistent with the forecast even on the previous day, that we should have wind "W.S.W. to N.E. and back, gales to moderate squalls, with rain." Nor was the gale from the west on Wednesday, the 30th, forecasted, unless we can interpret the stereotyped words "S.W. to N. and back, varying from moderate to strong; rain in places," as sufficient warning. It will ultimately bring our storm warnings into disrepute if the practice of attempting to forecast our winter gales for more than twenty hours beforehand is continued.

We must bring one fact into notice as showing the imperfection of the present theory of our storm warnings. Notwithstanding the repeated signals from London during the two last months to "expect dangerous winds from nearly opposite quarters successively," in no instance was this expectation realized. The storm in every case exhausted itself with the wind which ushered it in. The easterly wind came in like a lion, and its opposite, like a lamb. Verily, if any of these storms had a trace of the cyclone about them, they must have been only "half-circling!" This feature of diminished force in the westerly winds is characteristic of many of our autumn storms, though "the rotation of the earth" is common to summer and winter alike. We feel it would be little else than beating the air to discuss the simple philosophy of such points with cyclonologists.

If we would only follow the advice of Matteucci, and leave behind us what he terms "*les grand principes*," we

might, by having two-hourly telegrams of the fluctuations of the barometer sent directly from two or three stations on the west coasts of Ireland and Scotland obtain the earliest forecasts possible for ourselves. A great waste of time occurs at present by having too many stations, and by first having them discussed in London. The day is not far distant, we believe, when such a system will be adopted as a means of rendering the telegraph more useful in saving life and property. The particular features which any approaching storm (indicated by the fall of the barometer in the west) will assume at any point must be deduced from observations taken within a comparative limited area. A few simple rules and a very little experience would enable a coast station-master of very ordinary abilities to interpret impending changes with remarkable accuracy. It would surely, also, not be difficult to organise a system of minute guns to warn our fishermen, when out at sea, of tempests coming from the west, for they all come from the west.

We do fear we are letting out the secrets of our craft. In the *Board of Trade Report* for 1864, we find a passage which, at first sight, seems to run quite counter to our views which have been just stated. Here it is, and let us examine it narrowly—"It is supposed by many, that forecasts of weather and their occasional results—advertisements of strong winds, or it may be of warning a tempest—depend *only* on notices sent from distant places at which a storm has begun. Nothing can be more fallacious. True it is that in 1861 we began with the belief that by such aid we might do so. But advances have been made from day to day, and during the last year or more cautionary notices have often been sent by telegraph to the furthest stations, even most towards the coming storm (to the windward of us), in good time to warn them of the preparation necessary to be made in an exposed seaport, such as Valentia or Aber-

deen." Now, "*parlons l'Anglaise*," what storm ever came from Aberdeen and travelled to any part of England—shades of cyclones tell us! And, pray, was there ever a storm in which, writing at London, it was correct to talk of Valentia being "to the windward of us?" The barometer sometimes falls considerably at Valentia, as at other places, and no great storm occurs. What we maintain is—and we challenge Admiral Fitzroy or any one else to show we are wrong—during winter, great depressions of the barometer attain their minimum many hours at Valentia sooner than in London, and hours at London than at Paris, hours at Paris than at Rome. In the winter storms, great falls of the barometer at Valentia are rapidly propagated on to Italy. Admiral Fitzroy denies this in one place; but truth always oozing out, so we shall prove the truth of our statement from his own admissions. He says, in his instructions to Matteucci—"Turin, so near Alpine ranges, and to the north-west of all Italian coasts, must depend chiefly on French and Spanish observations for indications of weather." But we need only observe, the French depend chiefly on the Irish observations, and so also, therefore, must the Italian. But the "fallacious" doctrines to which he adverts may be those of the cyclonologists. True it is, when Admiral Fitzroy began his system of storm warnings, he was in the belief that all storms were gigantic whirlwinds, moving from south-west to north-east, of that *monstrum horrendum* character which he now derides. No wonder, then, that his ideas on forecasting storms should have undergone such amazing changes. Had storms consisted of whirlwinds of small or of large dimensions, progressing from south-west to north-east, the system of forecasts would have been of the most simple and consistent character, for similar phenomena would have been repeated from Valentia to Aberdeen, as well as corresponding phenomena over all lines

drawn from south-west to north-east. But what order can be forecasted out of storms which are now said to be only "half-circling or cyclonic?" The system of forecasting storms cannot be yet held as at all perfect. This should induce Admiral Fitzroy to walk, like his colleague Signor Matteucci, "very modestly," and not set down all who dispute the soundness of his reasonings or the infallibility of his favourite authorities as mere "amateurs" or "sciolists."

The particular direction in which the wind will set in from, at any place over which a depression of the barometer may pass, will depend upon the height of the barometer at [illegible] within a comparatively limited area. The winds will [illegible] within that area. What example, [illegible]ll of the telegrams [illegible]e are other [illegible] now enter [illegible]ld be much [illegible], one of the Hebrides, than from [illegible], from both these places would enable us to anticipate [illegible]r particular character here with comparative certainty.

During the warmer season of the year many of the features of atmospheric disturbances are changed, owing to their rate of progression or propagation being usually much slower. Then the north or north-west winds lose their influence over the south of Europe, for the same reason that the northers cease to vex the Gulf of Mexico in summer. The lines of minimum barometer that propagate themselves over northern Europe are seldom to be traced in the Mediterranean in the hot months. The principles of forecasting storms, however, are the same throughout the year. One consequence of the slower rate of motion of storms during

the warmer months is, that Admiral Fitzroy's warnings then often anticipate the approach of storms for a longer period.

In conclusion, we will only observe that, as the features of our winter storms are most strongly marked, their *modus operandi* is most easily traced. Great falls of the barometer are first observed on the westmost coasts of the British Islands. These depressions are of great dimensions from south to north; and these elongated areas of depression travel rapidly from nearly west to east over the Continent of Europe. This is a matter, we assure Signor Matteucci and others, which has been abundantly proved by the observations of the Meteorological Society of the Palatinate eighty years ago, as well as by the researches of Birt, Espy, and others. But the head of the department for warning the Italian coasts of approaching storms can easily examine this point for himself. We hold the west coast of Ireland as the *Ultima Thule* of the forecasting region. Valentia during winter, therefore, furnishes the means of giving the earliest notice of impending storms, alike to Rome and St. Petersburg, as well as to all places throughout the intermediate territory. R.

[The foregoing letters originally appeared in the *Scottish Farmer* for 1864.—"B."]

THE METEOROLOGICAL DEPARTMENT OF THE BOARD OF TRADE.

[The following letter, which originally appeared in the *Scotsman*, of 28th July, 1866, is of special importance, as no decision has yet been arrived at by the *new* Department, on the subject of "Storm Signals."—"B."]

On the death of Admiral Fitzroy, a correspondence took place between the Board of Trade and the Royal Society of London, with respect to the Meteorological Department. This resulted in the appointment of a committee, consisting of Mr. Galton (General Secretary of the British Association), Staff-Commander Evans, and Mr. J. H. Farrer, nominated respectively by the Royal Society, the Admiralty, and the Board of Trade. They were enjoined to consider and report upon the entire system of the Meteorological Department, and to offer any suggestions for improving upon the method of investigations at present pursued. A Parliamentary Blue-Book of forty-three pages, with an appendix containing about as much matter, has just been issued by this committee. The report enters pretty fully into the whole subject, and does not by any means give a favourable view of the manner in which the Department has hitherto been conducted. Taking all the circumstances, however, into account, it appears to us that the committee is rather too censorious. The Royal Society, in a letter to the Board of

Trade in 1855, sketched out the subjects which they considered most worthy of investigation, and the Meteorological Department was instituted in accordance with the views set forth in this letter. Though many of the points desiderated there are perhaps of considerable value in a mere scientific point of view, yet they are of little use for practical purposes. And, besides, they required an immense collection of observations, extending over many years, and withal a much larger staff of assistants than Admiral Fitzroy had at his command. Finding himself overwhelmed with collected materials which could not be turned in the meantime to any practical use, Admiral Fitzroy struck out a new line of research by establishing an admirable series of meteorological stations, and making trial as to the practicability of forecasting storms. The committee rather make reflections that almost the whole money annually voted to the Meteorological Department should latterly have been devoted to this end. We do not imagine that the country in general will acquiesce in the views expressed on this subject, for the name of Fitzroy will long be honourably associated with the first attempts to render the telegraph available in giving warning of changes in the weather, and thus turning the observations at once to a practical purpose.

The truth is, the science of Meteorology never had a more zealous and truth-seeking disciple than Admiral Fitzroy. What rendered his labours more irksome and severe was, that he had never mastered the elements of the science, as firmly established by Dalton, and extended by Espy. His published writings were largely composed of painful attempts to reconcile the views and theories of others which were contradictory and antagonistic. The Royal Society did nothing to smooth his way, but rather the opposite. In the committee's report, we have a great deal of criticism—severe criticism—on the manner in which this department has been

conducted. But when we analyse the grounds upon which this is based, and any suggestions for improving the present system, the committee betray a singular want of correct knowledge of the subject.

As our remarks must necessarily be limited, they shall be confined chiefly to that part of the report which deals with the forecasting of the weather, as this will prove most interesting to general readers. The committee recommend that Government should expend considerably above £10,000 annually on Meteorology. But if this sum should appear too large, that part at present devoted to weather telegraphy should be "postponed," as they look upon it in its present condition, so far as regards "rules and principles," as "discreditable to the country." They have arrived at the erroneous conclusion that a satisfactory system can only be founded on a new system of observations which they propose, whereas it may be safely maintained that the present observations are much less faulty than the use that has been, or proposed to be, made of them. The committee, in examining into the practice of the Department in foretelling the weather, find that it is not carried on according to any definite rules, and that the principles or maxims are not founded on any sufficient induction of facts. The forecasting of the particulars of weather and storms over Britain, after the telegrams from the out-stations are received in London, occupies "about half-an-hour, and is conducted mentally." The committee have not been able to find any maxims for present practice, and they certainly are entirely at a loss to suggest any calculated to lead to improvement. They imagine that a new system of observations, involving great expense, is required for such a purpose. But the question is, has the most been made of those which are already in existence? We think not; and we maintain that a useful system of weather telegraphy might be founded on the

present, at least as far as, under our particular circumstances, it is possible to do so. Only let the whole subject be robbed of the mystery that surrounds it, and placed upon a simple footing. It is out of the question in the meantime to aim at all the "completeness and exactness that science requires;" but little or no scientific knowledge is required to found and carry out a useful system of storm-warnings over Europe with the observations we at present possess.

The truth of this proposition will be rendered evident by what has been done in Italy. There, M. Matteucci has established the most perfect and useful system that exists in Europe, and it is so far a model for general adoption. But he has plainly told us he has no pretensions to a profound scientific knowledge of the subject, or any wish to become acquainted with the grand discoveries of Dové. When he was in course of organising a Storm-Warning Department, and in search of maxims for guidance, the present writer informed him that he must in the main rely upon the fact that "*all the great winter storms are propagated from west to east over Europe;* that they first invade Ireland, and afterwards travel towards the east." M. Matteucci would scarcely credit this assertion, as it was antagonistic to the views of most European meteorologists, who, in imagining that storms are of the nature of cyclones, *will* insist on storms having a course towards the north-east. In this conflict of opinion, M. Matteucci was simply recommended to examine the facts for himself. We now find, from a letter by the President of the Royal Society appended to this report, that this is the foundation upon which the system of warning storms in Italy rests. This ought also to form the guiding principle in establishing storm-warnings in any part of Europe. The telegraph might enable every country in Europe to know the state of the barometer on the west coast of Ireland; and as great depressions there are to a greater or less extent propa-

gated over Europe, atmospheric disturbances can by this means be anticipated.

One fact the committee seem to have entirely overlooked —that it is quite impossible to foretell or give warning of storms on the west coast of Ireland by means of telegrams. The atmospheric disturbances all issue from the Atlantic, and the west-coast stations are only of use in warning stations to the east as well as to the south-east and north-east. As we shall by-and-by show, instead of any attempts being made by the Board of Trade to foretell the direction, force, &c., of storms, the height of the barometer and the rapidity of its fall should be sent direct to those stations where signals are to be hoisted. The hoisting of signals should be left to the station-masters of the Coast-Guard, after they can compare the state of their own barometers with that on the west of Ireland. Signor Matteucci adopts this plan on the Italian coasts. A fall of the barometer in the west is telegraphed to the ports where the signals are to be hoisted. If this method is adopted, it is scarcely possible that the storm can precede the warning telegram—a state of things that almost always occurs at some stations under our present system. We wonder much that the committee did not perceive that something was radically wrong, when they are aware that more than one-third of the storm-warnings under the present system are too late, inasmuch as the storms are raging before the signals are hoisted. We again repeat what we pointed out many years ago, that, until the telegraph is laid across the Atlantic, it is quite impossible to give warning of storms by telegrams on the west of Ireland. Even in nine cases out of ten of the storm-warnings sent to Edinburgh, the gale is blowing before the signals are hoisted. Owing to there being no telegrams on Sunday, it has sometimes happened that a storm has been blowing forty-eight hours on the Monday before the signals were ordered to be

put up. To obtain the best possible results, therefore, owing to our proximity to the Atlantic, the station-masters must be on the watch to hoist the signals at the several ports, when the state of the barometer on the west coast of Ireland is made known to them by telegraph.

The report, when fully analysed, clearly shows that the Meteorological Department has attempted far too much in particularising the probable developments of storms in regard to force, direction, &c. So far as these are practically attainable, they might be left to the skill and experience of the Coast-Guard station-masters. This may at first sight seem a strange assertion, considering the complicated phenomena to be dealt with. The committee have arrived at some rather curious and mistaken notions in discussing these points. For instance, they recommend that the warnings for the "force" of gales should be continued, and those for "direction" discontinued. The first, after an elaborate comparison of the actual with the forecasted, has been found in six cases out of eight to have been correct; while the second have been found correct in only three cases out of eight. Now, we are rather surprised that it never occurred to the committee that the success as regards "force" must have been arrived at by the merest chance; for upon whatever theory the winds are explained, it is quite out of the question to calculate the force of any wind without first knowing its direction. To calculate the strength of a gale is one of the most difficult problems in Meteorology—indeed only one or two physicists have attempted it. The advocates of the cyclonic theory have never looked at it—indeed, they have utterly failed to suggest a motive power at all. But notwithstanding this, for very obvious reasons, "force," though the most difficult element to calculate on scientific principles, is the *one* most easily guessed at approximately. The force of winds being reckoned by a scale from 0 to 12,

and as observers, having no instruments for guidance, must necessarily put force down somewhat arbitrarily, it is easy to see if the warning for force extends over a few figures well up in the scale, that the chances are that the warning will be right if a storm does follow. For reasons that could be given, it would be much easier to calculate the amount of rain that would fall at any given place than to calculate the actual force of a gale. On this subject, the old rule laid down by Espy is the only one to guide us—*i.e.*, the force of a gale will be in proportion to the suddenness of the fall of the barometer rather than its extent. But while the committee recommend that the warnings for "force" should be continued owing to their comparative success—though they cannot discover the principle on which they are founded —they recommend that the warning for direction should be discontinued, as they consider that "the knowledge requisite to make warnings precise in point of direction does not at present exist." In reply, we say that it does exist, and forms one of the simplest principles in the science. At any given place, let the height of the barometer be known in the four quadrants of a circle, say 100 miles in diameter, and the wind will blow from that part where the barometer stands higher to that part where it stands lower. There are no exceptions to this law any more than there are to the law that water runs down hill. But, for all practical purposes, direction under the system we recommend might be safely left to those who are to put up the signals. If there were reason to suspect that a storm was impending, the direction could easily be given, as the various winds usually begin to breathe long before they blow from their respective quarters.

We quite concur in the committee's recommendation that the daily forecasting of the weather for two or three days beforehand should be discontinued. We do so, however, on grounds different from those stated. When it is considered

that more than one-third of storms signalled preceded the hoisting of the signals, it is abundantly evident that ordinary weather cannot he forecasted, since the storm-warnings show that in such cases the daily forecast of ordinary weather for three days beforehand was wrong. If fine or ordinary weather has been forecasted, and reliance placed upon this, a false security is given that no storm will occur in the interval; but the fact is, storms under the present system frequently precede the telegrams intended to announce it. All the facts collected, and which are literally buried in our Blue-Books on this question, indicate the great rapidity with which storms travel from west to east over Britain. They also clearly show that storms will in a vast number of instances outrun the telegraph if the motions of the barometer be not carefully watched on the west coast of Ireland, and made known to all stations to the eastward where signals are to be put up. It is quite a mistake to have the warning office in London, with telegrams from the west only once a-day; for, as at present carried on, so great a loss of time occurs as renders it impossible to give warning of atmospheric disturbances.

To obtain materials for a full discussion of the nature of storms, and the rate of their progression, nothing could be better than the plan recommended by the committee—to establish six stations with self-recording instruments. This, however, would involve an annual expenditure of several thousand pounds. At the same time, we may remark in passing, that no arrangement of these self-recording stations could be more out of place than that recommended by the President of the Royal Society. He proposes to place them at nearly equal distances in a meridianal direction from the south of England to the north of Scotland. But such a distribution, it must be evident at a glance, would entirely fail in showing either the direction or rate of progression of

storms over Britain. The stations ought surely to be arranged so as to embrace the extreme points of the whole country over which storms sweep. If storms have a westerly precession, we should rather have more respect to their arrangement on latitudes than longitudes. Though a few self-recording stations would be of great value, yet in many cases the same object might be attained by giving grants to some of the present observatories, and having almost continuous observations—such as are at present made at Greenwich, and Highfield, in Nottingham. At the present moment, too, we have self-recording stations at Oxford and Liverpool. These, with the vast number of observations taken over all parts of the kingdom, are quite sufficient for almost every purpose. We are literally overwhelmed with materials, and no proper use is made of them. Nor do the committee seem to have any clear idea as to what particular line of inquiry ought to be followed with the new observations which they are desirous to obtain.

A perusal of this report will impress every one with the conviction that little or nothing has been done in establishing any principles in Meteorology that are available for practical purposes since the Royal Society's letter to the Board of Trade in 1855, which induced the Government to give grants for that Department. This letter, indeed, sketched out no clear line of inquiry, such as modern views and discoveries might have indicated. On the contrary, we find that some of the fundamental principles of the science are misstated; and some rules are required of Admiral Fitzroy which neither he nor the Royal Society could give—for the best of all reasons, that they could not be given. For example, the Royal Society demands that "clear and simple directions for distinguishing between cyclones and gales of an ordinary character should be issued for the benefit of navigators." The committee do not allude to this subject at all, but now

tell us that "real cyclones are comparatively rare," which is certainly a great change from the time when Reid, Redfield, and others, asserted that all winds were of that character. Still more amusing are the straws of evidence at which the President of the Royal Society, in his letter of June, 1865, catches, to show that such things do really sometimes happen. Mr. Babbington, now at the head of the Meteorological Department, is appealed to on the point. He says, there are "three or four in a year perhaps; and they are, I think, more common in summer than in winter. The direction of their motion is certainly almost invariably towards some point between N.N.E. and E.S.E. With regard to the rapidity of their motion, I scarcely feel able to express an opinion." How can the President consider this as "satisfactory evidence," when the exact course and rapidity of their progression has not been ascertained; and who that has studied the rudiments of the science can assent to the doctrine that summer cyclones are produced by "the brushing (?) against each other of the north-east and south-west currents." All this shows that the whole phenomena of atmospheric disturbances have in this country as yet been only examined by the loosest methods. Neither the Royal Society nor the committee seems to be aware that Espy discovered that there is what he has termed "a line of minimum barometer" in all the storms of America and Europe. It is simply impossible to comprehend the nature of atmospheric disturbances, and their rapidity of propagation, without first recognising the accompanying "line of low barometer" that in all cases stretches from the south to the north of Europe. The recent publication of M. Matteucci is surely sufficient to make our British meteorologists calmly reconsider the whole question, and take nothing for granted, whatever the weight of authority may be in its favour. In short, the blind assent that influential societies devoted to the promotion of science

have given to the cyclonic or rotatory theory, is the chief cause that so little advancement has been made in Meteorology.

The committee further recommend that the arrears of British weather for two years should be charted and discussed on the method adopted by M. Le Verrier. But we are quite at a loss to discover any useful result likely to arise from such an expensive proposal. Though the French system of charting the weather gives an interesting and pictorial representation of certain of the phenomena, it is quite unsuited for analysing their nature. Notwithstanding that the system has been in use in France for several years, it has failed in putting us into possession of a single maxim or principle by which the committee, while condemning our own system as "incomplete and unsatisfactory," and as "discreditable to the country," could furnish suggestions how ours could be improved. On the contrary, they call for a new system of observations, involving a heavy expenditure, without having any clear views as to what use is to be made of them after they are got. We have collected quite a mass of observations; yet the committee cannot tell the course that storms take over Britain, the rate of their progression, or the nature of the phenomena. All this will be found to have arisen from ignoring and setting aside the labours of others in this department of science, as if the scientific reputation of this or that influential member of the Royal Society were as sacred as the property of individuals.

In conclusion, then, we think that, in opposition to the recommendation of the committee, the system of weather telegraphy should be simplified to the utmost, and continued, even although all the other reductions, &c., of observation should, in the meantime, lie over. Indeed, the reduction and discussion of the proposed million and a-half observations taken at sea will prove of comparatively little practical value.

It must be borne in mind that Lieutenant Maury has already reaped the chief fruits in this field of research. For scientific purposes, the most extensive series of "means" is in general really of little use. We need rather to analyse, to separate, and to divide, in order to show why one day so often differs so much in character from the next. As we have already said, however, a useful system of weather telegraphy might be established with the observations and stations that we now have, and little or no scientific knowledge is required to carry it out. Let the Royal Society and Board of Trade recognise the fact (which, if they doubt, they can easily test) that atmospheric disturbances are first indicated by a falling barometer on the west coast of Ireland, and are sometimes propagated towards the east with a velocity of nearly forty miles an hour, and they will readily recognise the best means for making storm-warnings of real value. Every one who is in the habit of observing the face of the sky, and of forming guesses as to coming changes of weather, would be made really weather-wise could he but know the motions of the barometer on the west coast of Ireland. Were our Coast-Guard station-masters in possession of this information, by means of telegraph they would be enabled to signal storms far better than can ever be done by a central office in London making the merest guesses as to the particular character of the weather that is to follow certain indications. It is fortunate we have the Italian system in all its simplicity as a guide; and the sooner we copy that example, the sooner will we turn the telegraph to a useful account, and rescue the whole subject from the mystery in which it is at present involved. R.

THE ASTRONOMIC LAW OF STORMS.

"CHANGES of monsoons, storms, heavy and perhaps continuing rains, everywhere, more or less, are recurring evidences of the very general accordance, similarity of action, and most extensive intercommunication always existing in our atmosphere. In such grand disturbances as these, the lunarist and astro-meteorologist should endeavour to trace the influences of moon and planets. Welcome indeed would each proved effect of either be, duly eliminated from masking effects of other causations."—*Weather Book*, by Admiral Fitzroy, p. 212.

To the Editor of the "Mark Lane Express."

SIR,—On the earlier days of last week, continuous details were published in the daily journals of the terrible disasters and loss of life from the violent gales which so suddenly sprang up on the 18th inst., and prevailed with such intensity through the two following days.

Now, sir, in regard to these terrible visitations, unhappily of but too frequent recurrence, not only has the connection between their occurrence and planetary position been constantly ridiculed by "really scientific men," but it has been distinctly declared by Admiral Fitzroy, and reiterated by the above class of philosophers, that there exist no means of foreseeing the occurrence of any such phenomena, more than forty-eight hours in advance. This dictum was certainly

borne out on the present occasion. The meteorological report of the Board of Trade, published in the daily journals, furnished no indications whatever, even up to 8 A.M. of the 18th, of any atmospheric or barometric changes likely to give origin to any such disturbance. Hence the "probables" of the Admiral hinted at no more severe caution than "fresh and strong" to the 20th. The wind column of the returns of the 18th gave a mean force of only 4·12 at nineteen places, seven representing a "moderate gale." The only exceptions were Aberdeen, Penzance, and Plymouth, where the force marked 8. At the other places the force was very light. At Leith the contrast was still greater, the force marking as low as 3. Sailing from this port, the various coasting steamers were compelled ere nightfall to run back again, under the most trying and difficult circumstances, for refuge from the gale so suddenly and unexpectedly encountered outside.

We here see a "Meteorological Department," not only furnished with all the most delicate instruments which the refinements of science can produce for the registration of the pressure, temperature, electricity, and moisture of the atmosphere, but also in connection by telegraph, not only with every seaport in the kingdom, but also with the greater part of Europe, every twelve hours; yet such was the general absence of indications, that it was not till the afternoon, when the gale was actually in existence, that warnings could be sent round the coasts—a fact which not only puts to flight the forty-eight hours' law, but demonstrates at once the fallacy of the theories upon which the science is based.

The mind naturally asks, Is such a state of helplessness unavoidable? I think not, as I will endeavour to show. Some months ago you did me the favour of inserting a letter on the seasons and rain-falls, in answer to the above challenge of Admiral Fitzroy's. Knowing the value of the

science, I was desirous that it should have the fullest justice. I therefore forwarded a copy of your journal to the Admiral, along with an elaborate explanatory diagram, drawn up according to the formula of the Department, showing, in connection with the planetary positions, a complete record of the phenomena of the weather, as furnished by the barometer and thermometer, and the reports and warnings of the Board of Trade. In so doing, I drew his attention to certain phases of paramount importance to the study and comprehension of those critical changes for which the months and seasons were so remarkable, and for which the elucidation had been hitherto sought in vain.

Having done this, I drew his attention to the future, giving him the following "linear diagram" of the position for October, 1864:—

x	Ma.	My.	V.	S.	H.	N.	J.
2	8	10	11	16	20	28	30

I had pointed out the influence of Mars, Mercury, and Venus upon atmospheric condition. I, therefore, writing on the 7th, and adverting to the extreme height of the barometer, the general calm and dryness, begged of him to observe the effects of the changes which would be induced by the culmination of the positions of Mercury and Venus about the 12th, as denoted by the barometer and by the increased activity of his Department.

From the 7th to the 12th, the barometer fell 8-10ths; on the 12th, it fell 11-10ths. Gales at twelve places (against three places the first eleven days); and the first of a series of "drum" warnings to the coast, which lasted to the close, except on 20th-21st. On the 11th, the rain-fall was 0·23 inches at two places; the double return of 12-13th gave 9 inches at sixteen places. The first eleven days gave a fall of 3·32 inches at twenty-seven places, against 82·21 inches

at 220 places in the following eighteen days; or a ratio of about twenty-five to one. The gales were, three places in the first eleven days, to 137 in the last eighteen days—a ratio of forty-five to one.

To those who remember the harrowing scenes on the Black Middens, off Shields, the period will be too well known, and too well testify to the "terrible influence" of Venus, so detrimental to the nervous susceptibilities of your correspondent, "C. 2."

This, sir, was the first "trace" I gave the Admiral. In the diagram of December he had an example of temperature, issuing only one warning, and "probable" gales on four days, justified by their occurrence at two to four places. The next "trace" was furnished by the diagram of January, with the following positions:—

x	J.	Me.	x	H.	S.	Ma.	N.
2	7	8	12	16	20	22	25

Here we have the next occurrence of the solar conjunction of Mercury, on the 8th. On the 7th, the barometer marked 30·40 inches; on the 8th, 29·70 inches; rallying to 29·91 inches on the 11th. Absolute reaction then set in, and depressed the mercury to an extraordinary general minimum of 28·40 inches. From the culmination of the 8th, the most terrible gales raged all over the kingdom, doing again appalling damage; the Admiral issuing his first warning on the 9th, and repeating them daily to the 18th, along with continuous "probables" of gales. The "warnings" of the month numbered nineteen days, against one in December. Gales at 192 places to 64 in December. The rainfall was the heaviest return for seventeen continuous months—101·38 inches at 284 places, against 57 inches at 201 places in December.

Putting these facts thus before him in unmistakeable

diagrams of his own returns, I gave him the positions for the next two months, drawing his attention more particularly to that of March 18, as the next example of the "recurring period" of Mercury, and as one equally worth his study. The position stood thus:—

x	Ma.	H.	J.S.M.	N
4-5	13	16	18	28

As stated above, the morning of the 18th gave not the least indication; but scarcely was the position complete, than a furious gale set in; and once more the Meteorological Office bowed before its destiny, of demonstrating the power of planetary position, by issuing its stern warnings on the exact day to which attention was drawn *a month in advance.*

Let me give one more "trace" ere I conclude these mercurial illustrations. In February, 1860, the earth encountered the following position:—

J.	S.	N.	Me.	H.
6	12	15	19	23

in which Mercury appears again conspicuous. Like the 18th instant, the day was calm, yet with the mildness of spring. The conjuncture was complete at 3 P.M. Within two hours the reaction was so great that the wind blew a complete hurricane for some hours, the night finally ending in an intense frost, the maximum of the 17th having been 44 degrees. This was remarkable for the following observations which it drew forth, in *Chambers' Journal* of April 28th, so illustrative of our present meteorological condition:—

"Meteorologists are collecting observations on our unusually backward spring, to compare with the records of past years, as a further help in examination of the question as to the 'weather cycle' theory. The same atmospheric condition appears to have prevailed over the whole of

Europe, accompanied in several parts of the Continent by combined thunder and snow-storms. Of these the most remarkable occurred in Belgium, on February 19, between 7 and 8 P.M., when, besides an unprecedented fall of snow, twelve churches were simultaneously struck by lightning, at places wide apart—Liege, Courtrai, Malines, Antwerp—comprising nearly the whole breadth of the country. Some of the churches were completely destroyed, and the others more or less injured."

Thus "tracing" these few periods and their phenomena in a few links, have we not a chain of facts of indisputable value to meteorological science? Yet what have "meteorologists" achieved? How far have they arrived at any knowledge of the "weather cycle," which will enable them to furnish any rational or scientific clue to the storms and snows of our present protracted winter, or the unusually backward spring?

In vain are all efforts. Five years have now elapsed, during which period every resource that science and power can render has been given to the aid of meteorological investigation. With what results? The theories upon which the science is based are even yet so unsound as to prevent our knowledge of some of the most disastrous storms even twelve hours in advance. Still further: in another "department," after fifty years of the most accurate and comprehensive observations, one of the most able investigators states that he has been utterly unable to obtain from them even the slightest clue to the singular extremes of temperature presented by the different months and seasons —that we must go on for another hundred years! At the least, a quarter of a million of money has been expended in observatories, public and private, with but this barren result, for no other reason than because we dare not release ourselves from the thraldom of so-called "science," and recognise the

wisdom of Providence in creation, by tracing the influence of the planets in connection with meteorological phenomena.

How much might be gained, the facts I have adduced will be sufficient evidence. That they have been "duly eliminated from the masking effects of other causations," I think will be pretty clear. But I have taken care to give still more tangible and indisputable proofs, not only as to these "recurring periods," but also as to the several theories of solar, lunar, and planetary causes, and which can only be illustrated by diagrams.

That such "proved effects" are so "welcome" as implied, is much to be doubted, from the unwelcome reception they have met with. But I have taken up the task in the cause of humanity, in which the wounded pride and shattered theories of the greatest men should weigh as nought in the balance, against the lives of brave men and the sufferings of bereaved orphans. Unwelcome as these facts may be, therefore, I hope they will serve my only purpose—that of procuring for the science all that Englishmen ask, "a clear field, and no favour."

I have, sir, at different times, had the honour of occupying your columns at some considerable length, in defence of this sublime and useful philosophy, both against the fallacies and absurdities of "astro" lore and the ignorance and bigotry of the "really scientific" class of philosophers. In so doing, I have, no doubt, involved you, as well as myself, in much of the odium and contempt so lavishly bestowed on all who engage in the defence of unfashionable truths. In thus completing my task of proving, by the operations and records of the "Meteorologic Office" itself, the reality and influence of planetary positions, I have done all, in answer to the challenge, that could be demanded by the most querulous sceptic. I therefore once more trespass upon you with these

facts, as well for our own vindication as for the advancement of a science of such world-wide utility.—I am, sir, yours obediently, FREDERIC PRATT, M.B.M.S.

228 Hackney Road, March 28, 1866.

No. II.

WEATHER INFLUENCES IN AUGUST.

TO THE EDITOR OF THE SHIPPING AND MERCANTILE GAZETTE.

SIR,—On a review of the meteorological features of the month now passing away, I think the evidences of a philosophy in nature, in respect to the influence of planetary position upon the weather, are sufficiently obvious to warrant me again bringing the principles before the observation of your readers. For instance, in July, the principal dates of influence were, the 1st, 7th, 14th, 16th, 20th, &c. The first period I find marked by a barometric depression of 0·94 inch on June 30, with gales on the coasts; the 7th by the next depression, and a further recurrence of gales, and the commencement of the thunderstorms, further continued on the 16th, followed by the indicated reaction and further heavy weather on the 19th. In further conformation, I find that Board of Trade "coast signals" were also hoisted on the 1st, 7th, and 19th. Turning to the practical illustration of the Great Eastern, there are still further proofs of the value of the science in periods of doubt and hazard, as evidenced in the delay of the expedition through the stoppage of operations by the heavy weather of the 7th, and the subsequent nearly ill-fated period of 16-20, in which, misled by the fine weather and high barometer of that culmination, the expedition was induced to start, only to meet with the heavy weather of the reaction, in which the total foundering of the Caroline, with the shore cable and all on board, was only averted by the parting of a hawser—all which events and

periods I claim as proof of the reality of the science and the accuracy of its principles, having not only pointed out the possible hazard in your Journal sixteen days previously, but also in a personal communication to the Chairman of the Committee of Construction as far back as the 29th of May, about 48 days in advance. I need scarcely say, that every resource which science can afford has been tried, in the hope of obtaining some clue to such vicissitudes, periods, and extremes, but in vain; and it is now constantly repented by the most eminent authorities that we are without any means whatever to judge of the weather for more than 48 hours in advance. The above facts show that for "hours" we might substitute "days;" and it is even within the reach of science to make those days "weeks," and even treble the number.

When we think of the number of lives, and the millions of property which yearly fall a sacrifice to these terrible visitations, the value of a philosophy which would enable us to approximate to anything like the precision denoted by the above facts must be evident. That we have not attained it, has arisen from the science not being rightly understood. From long experience, as well as from rigid investigation, I think that I could do justice to the science and its principles. I therefore hope that you will further continue the favour of your columns for the few months of 1865, that I may bring the several "positions" before the notice of your readers, for practical observation and test of their reality.

The position in August will be seen by the following linear diagram. A B representing by the letters the planetary rays by which the earth's path is intersected at the dates beneath, forming "periods" of influence of which the letters are the culmination, the mark (X) the boundary, or point of "transition";—

N	X	Ma.	J	X	S	X	H
A———							———B
2	5	8	11	14	18	22	26

The ensuing month will be more remarkable for its illustration of the influences from which spring the peculiarities of our seasons—a principle which has for basis the relative rate of motion of the planets, and more particularly that of Mars and Venus. The rate of motion of these planets is so near that of the earth, that, travelling together, the angular positions formed between them and the earth are often protracted for a considerable period; the same principle, on the other hand, being also the cause often of a considerable interval between the positions, as well as of an irregularity constantly changing the months of their occurrence. When we consider, therefore, that Mars is generally inducive of considerable evaporation, development, and sustentation of temperature, that Venus is similarly inducive of condensation and downfall, we may see how much the nature and productiveness of our seasons, the safety and perils of navigation, depend upon the presence or absence of these important influences. For instance, in May we had these important positions:—

	V		M		V	
A						B
	8		15		31	

or two positions of Venus to one of Mars. In consequence we got a month of heat and moisture, of rain and sunshine, of the highest value to agriculture; while the three periods were all occasions of violent storms, perilous to commerce. The 8th was the occurrence of destructive hailstorms in France; the 15th of the hurricane at the Cape, with the loss of 18 vessels; and the 31st of the Baltic storm, 50 vessels wrecked.

In August we have Mars *solus*, and also in such a relative position, that for 31 days the earth will be within six degrees of angular distance of the planet. Commencing on July 23, its influence is already visible in the heat and suspended

rain fall—peculiarities which will characterise more or less the following month. On the 2nd the earth comes within the focul influence of Neptune, which may add to the intensity of evaporation, which the close position of Mars will uphold to the 8th. If the extreme be great, some violent reaction may follow, in partial, yet heavy, rain or hailstorms, with thunder. But this will depend upon the previous extreme. If not great, the still close influence of Mars will sustain both evaporation and temperature till the passage of the earth beyond Jupiter, or the point between that and Saturn, of the 14th. If to this point, strong reaction will probably follow, with some heavy downfall, thunder, &c., with lower temperature and unsettled weather to the close. The month may thus present two equal periods of action and reaction. The latter may, however, commence on the culmination of Mars; if so, the latter portion will be more favourable.

The first portion, therefore, relates almost wholly to agricultural operations, and bids the farmer do all the work which the first eight or ten days will permit. From that time he stands the hazard. The latter portion will most concern navigation; and if the reaction take place about the middle, the 14th, 18th, 22nd, and 26th will develop some heavy weather, if not gales, on our coasts. Months thus influenced, however, are often difficult of forecast, from the tendency of the positions to a balancing of forces, the relative position and motion of Mars, sustaining the evaporation and counteracting the reaction of the less-enduring positions—these latter, in their turn, partially overcoming the former, and so far weakening the evaporative force as to cause the prevalence of cloud, gloom, and humidity of atmosphere, the prolific cause of blight to vegetation, and of extreme effects upon the public health. Such an instance was afforded by the January of 1864, a month singularly remarkable for fogs

(being winter), mildness, and absence of rainfall. I have, therefore, no doubt that the following month will again afford many points of interest for the study of the meteorologist, in unfolding the causes of seasons and their peculiarities; of drought, humidity, rainfall, and electric reaction; of contrasts of temperature; and of the influence of terrestrial position upon instrumental indications.

In offering the above remarks, let me disclaim all attempt to put them forth as predictions. I simply wish to be the guide, not the prophet; to offer the results of investigation and experience in such a way as may enable any one interested in the science, or affected by the weather, to trace out the operation and influence of causes hitherto unappreciated, and to understand so much of the profound mechanism of nature as will make observation a source of both pleasure and profit, as well as more conducive than at present to the general welfare of mankind.

I am, Sir, yours obediently,

FREDERIC PRATT, M.B.M.S.

Hackney, July 26, 1865.

Since writing this, I find the following remarks from the pen of the *Times'* correspondent:—

"The fallacious value of averages has never been more strikingly exemplified than in the weather predicted for all these Atlantic expeditions. The first of all took place in August, during which month it was carefully ascertained, by reference to logs and nautical authorities, that no wind was to be expected in the Atlantic. Yet at some 300 miles from shore the pitching of the Agamemnon in a heavy wind and sea parted the cable, and thus put an effectual end to both prediction and expedition for that year. In the following year it was attempted in June, during which month bad

winds were said to be unknown, and the result of that arrangement was, that the Agamemnon was for at least two days in hourly danger of succumbing to one of the worst gales that ever swept the Atlantic, and which culminated on the very day when storms were said to be unheard of—the 21st of June. This time July has been chosen as the period when it never blows "long or strong," and the Great Eastern was to have left here on the 12th of this month. Yet gales of unusual severity have retarded her till now. In the present instance the choice of July seems to have been more than usually unfortunate, inasmuch that it is stated here that last month was the calmest and finest known for years, while this month, on the contrary, has been precisely the very opposite."

"This time," I may truly state, there was no mistake as to weather. In spite of the contempt and ridicule with which any such attempt to caution would be received, it appeared wrong to see the expedition exposed to the danger and hazard of the period chosen, without offering some warning. I therefore wrote, and explained by diagrams the influences of both the past and present expeditions, and the possible coincidences of results. I begged of them, therefore, at least, to see the 8th (the "meridional storm" period) over, hoping that the results would be such as to induce them to further delay till the 20th. This it failed to do. Misled by prognostications of settled weather from the "high barometer" and "fine skies," the expedition was allowed to encounter all the terrific risks of the "16th to 20th" period. "The fallacious value of averages," and the utility and precision of the astronomic philosophy, were never more strikingly exemplified than on the present occasion. If the science is ever to become a philosophy, the judgment of "averages," and the registration of "means," must be abandoned as fallacies which lie at the root of all our failures to predict the weather "48 hours in advance."

No. III.

THE METEOROLOGY OF JULY.

SIR,—As example is ever a better teacher than precept or prediction, I beg to hand you the following table and observations on the weather of the past month, in further illustration of the influence of planetary position, if you deem them worth the attention of your readers:—

	Bar.	Temperature.				Wind.		Rain.	
		Me.	Mn.	Mx.	R.	P.	F.	P.	A.
1-My. Nep.	29·37*	...	61*	74*	17	...	...	...	...
2	...	50*	...	...	27	1	4·35	1	·10
3	30·20†	...	...	...	28	1	3·20	1	·03
4	...	...	...	85	19	1	3·55	11	2·08
5	...	...	...	...	20	...	3·00	8	2·63
6	...	63†	74†	85†	22	...	2·85	16	5·12*
7 (*x*) ...	29·82*	...	...	...	12	2*	4·15	12	5·86*
8	...	...	...	...	17	...	...	...	*
9	30·04	...	...	...	16	4	4·00	13	3·27*
10	...	...	...	...	16	...	3·50	17	4·99*
11	29·82	...	...	...	17	...	3·80	12	2·23
12	30·14	48*	61*	...	26	...	3·75	8	1·29
13	29·99	...	...	67*	11	...	4·70	13	2·89*
14 Jup. ...	30·08	...	...	...	20	4	4·60	4	·46*
15	29·97	...	...	85†	30	...	...	...	*
16 Sat. ...	30·16†	63†	71†	...	17	6	4·75	11	1·95*
17	...	63	...	...	16	1	2·80	9	·99*
18	...	...	...	...	17	2	4·05	17	4·94*
19	29·88	...	62*	69*	14	1*	3·50	12	2·56*
20—(*x*) ...	...	53*	...	...	22	...	3·55	5	·79
21	·98	. .	...	...	23	1	3·55	5	·58*
22	29·82*	...	...	...	17	...	...	...	...
23	...	60	...	...	16	...	2·95	8	3·17
24—Her. ...	...	...	...	...	22	...	2·60	3	·38*
25	...	...	...	...	22	...	2·35	1	·17*
26	30·46†	60†	...	85	27	...	2·56	4	·30
27	·30	...	72†	85†	26	2	4·20	4	·29
28—(*x*) ...	·36	53	65	76	26	1	4·10	1	·10
29	...	...	...	...	17	...	...	...	...
30	...	...	...	...	17	2	4·35	8	1·35
31	...	...	...	...	13	3	3·90	15	7·74
2—Nep. ...	29·68*	46*	54*	62*					
						32	94·45	219	56·26

Some slight difference will be observable on comparison with ordinary tables, which calls for a few words of explanation. In ordinary weather diagrams there appear two lines traced across, alternately ascending and descending, forming a curve of a broken and irregular figure. These are the curves of the barometer and thermometer, and supposed to represent the passage of "waves" of pressure and temperature of the atmosphere, of which the elevations are termed the "crest," the depressions the "trough." Coincident with these two extremes, nearly all the remarkable phenomena of meteorology are observable; the latter especially characterising all the most severe storms, hurricans, etc., so perilous to navigation. The object of meteorology is to discover the causes of these extremes or "waves," and their attendant phenomena; and in so doing resort is had to the taking daily of a certain number of readings from each instrument, and reducing them to a "mean" reading, from which monthly and yearly means are successively deduced. In the case of temperature, the "means" of the same day in each of 50 years have been added together, the means taken, and the means thus deduced formed into a curve, in the hope that such a result would show an unbroken curve of ascent and descent from January to December. In vain. The same extraordinary oscillations and breaks still appear; and although the work has been performed by the most able analyst that the science possesses, he states that the most searching investigation has failed to afford him any clue whatever to the causes of the extremes of heat and cold for which the several months are so remarkable. All that can be done is to go on for 50 years further, in the hope that the accumulated series will render an unbroken curve.

What we have to do with are the extremes themselves, the causes of which, it must be patent, can never be arrived

at by such wholesale obliteration; and that it is unnecessary, as well as useless, a very brief course of observation in connection with planetary position must suffice to demonstrate.

In the above table, therefore, under the heads of "Bar," and "Temperature," I have inserted only such readings as denote the respective "crests" and "troughs" of each wave, omitting entirely the intermediate readings, as without use. The readings are without manipulation of any kind; they, therefore, show the actual changes and condition of the atmosphere, the "trough" of each wave being distinguished by the *, the crest by the †. The "positions" previously given are transferred to the date column. Under the head of "Wind," I have availed myself of some of the data of the Board of Trade returns, as the most practical and most accessible that we have. In the column "F" I have here taken the "mean" of the force at twenty places, using the column "P" for the extremes, as showing the number of the twenty places at which the force was at and over "7" (a "moderate gale"). The * denotes the days of special coast "warnings." The column headed "Rain" is also from the same practical source, "A" showing the "total" amount registered at the number of the twenty places denoted in "P." The * against the amount denotes days on which thunder or lightning, or both, prevailed, as gathered from the "returns," and other sources.

With this explanation I may proceed to point out some of the peculiar features of the month, as they appear under the different heads.

Pressure.—Coincident with the double influence of the 1st appears the "trough" of the barometric wave, marking an extreme depression of 0·94 inch from the 27th to the 30th. Hence it rises to its maximum or "crest" on the 3rd. Under the influence of the transition, it marks a sudden depression from the 5th. From this period there occurs a

series of minor oscillations to the 16th, the next maximum, further continued to the 22nd, the next great minimum. Under Herschel, another maximum is attained on the 26th, from which it again declines under the influence of Neptune, to an extreme minimum on July 31 and Aug. 2.

TEMPERATURE.—Taking the mean of the two extremes, the "trough" of this wave also occurs with the Neptune position (61 deg.), whence the curve marks an unbroken rise of 23 degrees to the change point. It then makes the unbroken ascents in correspondence with the different positions denoted by the figures. With these the great extremes of day and night nearly coincide, the extremes of the former occurring on the 4th and 6th, 15th, and 26th and 27th—those of the latter on the 2nd and 12th. Under the head "R" are shown the daily ranges.

The principal features of the other columns will be best shown in reviewing the month.

Starting from the transition point of June 26, after the singular drought period, well marked reaction at once set in, both in temperature and pressure, along with general prevalence of rainfall, the last three days showing a fall of 2·34, 4·57, and 4·59 inches, at 8, 13, and 8 places, coincident with the unbroken depression of 0·94 inch in the barometric curve from the 27th, and a fall of twenty degrees in that of the thermometer from the 23rd. The force of wind on the 30th was also the highest of the month, 5·35, with gales at six of twenty places, and coast "warnings" hoisted. Under the immediate influence of the position, however, all extreme disappeared, the first three days producing only 0·13 inch of rain, with a rise of 0·83 inch in the barometric curve. From this point the rainfall again set in, increasing to a depth of nearly 6 inches with the transition of the 7th, although with a rise of 13 degrees mean temperature. From hence to the 20th the earth was under the combined

influence of Jupiter and Saturn, the culmination of which again induced a suspension of rainfall similar to that of Mercury and Neptune, though here with an elevation of 10 degrees of temperature. A further general prevalence and extreme of downfall followed, and the great reactionary period closed on the 20th, the earth then passing into the influence of Herschel. Under this influence, intense evaporation again set in, with the finest of weather, more sustained temperature and higher barometer, till the close of the period. The great rain period prevailed between the 3rd and 19th, during which the returns give a total fall of 41·26 inches, at 163 places, for the 16 days, against a fall of 7·13 inches at 39 places in the subsequent 11 days; the latter period standing in the ratio of 39 places 7·13 inches, to 112 places 28·66 inches in the former. The total of the month amounted to 56·26 inches at 219 (of 600) places, against 27·46 inches at 91 places in June, accompanied with a mean daily range of temperature of 19·7 degrees (only 3 degrees below that of June). This increase of rainfall was of the highest benefit to vegetation.

On inspection of the wind force, the difference in the "means" appears so slight, that it is only by reference to the column of "places" that we can distinguish the storm intensities. Of these the principal lay between the 7th and 9th and 13th and 18th—the first from the combination of intertropical storms with the fluctuation of the change of influence, and the latter from the combined intensity and reaction of Jupiter and Saturn. Minor intensities are also observable with the two periods of Neptune.

Concurrent with these are the fluctuations in the barometric curve, of which the period of 2nd to 21st presented a continuous series of slight but irregular oscillations. This was followed by one of gradual elevation and depression from 21st to 28th, both flanked by the singular depressions

of the two Neptune periods. The total fluctuation amounted to 4·88 inches, against 3·83 inches in June; the sum of the wind force to 94·46, against 87·20; that of gales to 32, against 24. Except the 7th and 16th the extremes were principally produced by partial and brief squalls.

For electrical reaction the month was very remarkable, as I gather that thunder-storms, etc., prevailed on no less than 15 days, against 3 in the previous month. They prevailed almost entirely through the reactionary period of Jupiter and Saturn, and most intensely about the culmination. On the 17th, in France, where such phenomena are more severely felt, a hurricane swept the districts of Cambray and Maretz, for 25 minutes, destroying houses and crops, and doing immense damage, besides throwing a train of 17 waggons off the rails by the force of wind. The terrestrial disturbance was equally prominent, several shocks of earthquake occurring in Styria on the 13th and 14th, followed by others at Catania on the 15th and 16th, destroying an entire village of 150 houses, and killing and wounding nearly 100 persons. Four other villages also suffered severely.

To many who may read this, the idea of deducing such stupendous effects as these from influences so remote will appear absurd. When, however, we come to compare the occurrence of the singular magnetic storms of the 3rd and 5th inst. with the Neptune and change positions of those days, as given in this Journal, and with the equally remarkable extremes of the two former periods, we may be easily led to conceive that there may yet be "more things 'twixt heaven and earth than are dreamt of in our philosophy." When to these may be added, that March 19, 1861, and April 22, 1863, both Neptune's positions were marked, the first by the destruction of the city of Mendoza, in Chili, and 12,000 of its inhabitants, the latter by the severe earth-

quake at Rhodes, which destroyed 400 houses in the city, 12 out of 44 villages, and 240 people, both periods being also marked by storms of great severity in these and other latitudes; and that on June 22, 1861, the French harvest was literally wrecked, and property to a million sterling destroyed, under a similar position—we may conceive the benefit that might accrue to science from a more general and simultaneous study of such periods.

At present no more can be done than to accumulate facts and tables similar to the above, leaving to the time when a few more similar collections of data will enable us to generalise, and to deduce therefrom a more exact knowledge of the laws of atmospheric vicissitude than we at present possess.

I am, Sir, your obedient servant,

FREDERIC PRATT, M.B.M.S.

Hackney, August 9, 1865.

No. 4.

WEATHER INFLUENCES IN SEPTEMBER.

SIR,—Sufficient "coincidences" must have already appeared to induce in the most superficial observer a belief in the connection between planetary position and the weather. I may, therefore, usefully venture a step in advance, in explanation of the nature and action of planetary influence.

The doctrine is of very remote origin. Under the name of "astro-meteorology" it was known to the ancients at a very early date, and, up to the present time, has formed the subject of several elaborate works in elucidation of its principles. Of these latter I may briefly state, that each planet was held to exercise a certain specific power for heat

or cold, storm or calm, drought or humidity; that this power was exerted in three modes—independently, by the planet itself, or through the agency of the moon; secondarily, by its coincidence with, or antagonism to, the action of the sun; and "mutually," by the combination or antagonism of two or more planets. "Independently," the position of the planet was immaterial; in "combination," an interval of a certain definite number of degrees between the planet and the sun or moon, or between two planets, was necessary. This was termed an "angle," the formation of which, in analogy to the laws of crystallisation, was supposed to generate a disturbing force, or antagonism, which, being communicated to the earth, as the vortex of the "angle," gave rise to all those phenomena and vicissitudes the observation of which constitute the science of meteorology. The influence, I may state, was quite of an "occult" nature. It had no relation whatever to any of the known laws of physical science. Hence, it baffled every attempt to unfold its mysteries.

Despite this failure, however, reason has always recurred to the possibility of an astronomical origin for such phenomena; and observation having revealed their occurrence in periods, or as intermittent extremes in a greater period, they were referred to the two luminaries as causes. The first theory was that of Lieut. Saxby, R.N., who endeavoured to show that all the great storms so destructive to maritime interests occurred in connection with certain phases and positions of the moon with respect to the earth and its equator. The theory was subsequently further enlarged by the late Admiral Fitzroy, who, taking the sun into the hypothesis, formed what was called the "soli-lunar" philosophy. Of this the sun formed the base, or "constant," its influence causing a continuous stream of evaporation from the regions of the equator, which, falling away towards the

two poles, thus created a constant atmospheric current, denominated as the solar tide. To this constant force the moon was the "intermittent," in producing a lateral tide, which, acting with force, broke up the continuous current of solar influence, and thus gave rise to the different intermissions and changes observable. In "phase" and "position" the lunar force became an extreme, and the antagonism thus created gave rise to storms and hurricanes, and their attended phenomena.

But, as will be perceived on reflection, these theories were incomplete. They only accounted for the causes of storms and similar atmospheric *disturbances*, leaving the great problems of the science—the origin of the seasons, and the great differences observable between years, seasons, and months—wholly untouched. As a philosophy, therefore, they have proved a failure.

Having thus briefly shown what has been done theoretically, the observer will be enabled to comprehend the system to which I have already introduced him, and of which I will endeavour to explain some of the elementary principles.

With astro-meteorology it differs in its first principles. Each planet acts primarily upon the earth, independent of solar or lunar influence, the force or influence being the result of planetary attraction, generated by angular position between the earth and planets, and producing results of action and reaction in accordance with the laws and facts of physical science. With the "soli-lunar" philosophy it partially differs; in so far that, while appreciating solar influence as a "constant," it assumes the planets as the "intermittent," thus displacing the influence of the moon, the recourse to which was evidently induced by ignorance of the real position of the planets.

The elements of the science are few and simple. The orbit, or path of the earth, we may assume as a circle, of

which the sun is the centre. This circle is divided into 12 parts, called signs, each containing 30 degrees, or day's course of the earth. Between this circle and the sun, two other planets, Venus and Mercury, revolve, in similar circles; beyond it, the five larger planets, Mars, Jupiter, Saturn, Herschel, and Neptune, in periods varying with the increasing distances of their circles from the earth. Taking a watch, for illustration: let the centre pinion represent the sun; the outer circle, the paths of the earth, divided into monthly portions by the numerals. Let us assume the earth just entering the VIII., or September division, with the planets Mars, Jupiter, and Neptune so situated that they appear in the 4th, 11th, and 17th sub-divisions, or days of VII., IX., and X., forming a series of angular or sign positions to which the earth will be subject in that time. Transferring this to a "linear diagram," we shall have the following:—

	M	x	J	x	N	x	
Sept. 1.							Sept. 21.
	4		11		17		

Assuming the planets to be stationary, the month would present three distinct periods of action and reaction. Beginning at the first, the earth would be in a sort of neutral territory—a "transition" period, characterised by gloom, thermal changes, opposing winds, and intermittent rains. Passing onward, the attractive force of the planet would increase, rarifying the atmosphere, which, expanding, would cause the vapour to disappear in solution, as well as form a vacuum for re-absorption from the earth—an action which would be still further increased by the augmented force of the solar rays, which, unimpeded by the presence of vapour would, from their influence upon the surface of the earth and ocean, generate heat, and thus give rise to a continuous stream of evaporation. Under this combination of soli-

planetary influence, this would continue to the 4th, or "culmination." Passing this point, the influence would wane—"attraction" would give place to "gravity," the atmosphere would be condensed; and the affinity between heat and moisture being thus destroyed, the latent heat would be set free, and the moisture, assuming a tangible form, would be precipitated in heavy rains, until arrested by the attractive force of the succeeding position.

In this way, the earth would meet the same positions month after month, as it pursued its yearly course, generating a monotonous series of intermissions in an annual solar season. The forecast of weather would thus be an extremely simple affair, and "means" and "averages" the highest philosophy. Unfortunately, however, the "method of nature" is of a much more complex character. The planets are not stationary, but move on in the same ceaseless course as the earth, completing their circles in periods varying from the two months of Mercury to the 83 and 160 years of Herschel and Neptune. Hence the endless changes and combinations of position, the impossibility of anything like a "cycle," and the failure of all attempts to gain a clue to the mysteries of weather science.

Let me, therefore, attempt a solution of this next problem of relative motion and position changes. Firstly, of Neptune. In 12 months this planet advances about two degrees, thus changing the positions of Jan. 1, 1864, to Jan. 3, 1865. During the year this planet thus influences nearly the same days of each month. Herschel travels through a sign in seven years, Saturn in four, Jupiter in one. During the the year, then, the positions of Herschel travel on about four days, of Saturn seven, of Jupiter 28. These positions, therefore, simply *change*. In motion, Mars and Venus come very near that of the earth, the former travelling a division in two months, the latter in less than a month. They, there-

fore, not only change, but are singularly irregular, both in occurrence and duration. When on the same side of the sun, the close rate of motion of the earth and Mars causes a considerable prolongation of both position and interval; when on opposite sides, the positions are of but brief duration, and of rapid occurrence. Hence the peculiar contrasts of seasons and periods thus influenced. With Venus the positions are still more singular and irregular. Compared with the earth, its orbit is so small that it only forms three positions, all close together, with often considerable interval between the series. Mercury makes but one position—that with the sun, between one and two months.

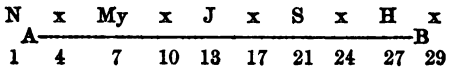
As a consequence of this diversity of motion and position of the different planets, we have the most singular extremes, without the possibility of similarity between any two periods. At one time, there may be an entire absence of position, as in February, 1855, marked by an uninfluenced period of 25 days, and the coldest February for 84 years. At another time, we have a rare combination, as on November 27, 1703, when the sun, moon, Mercury, Venus, Mars, and Jupiter were in one continuous line, with Saturn in position to the earth, from another sign —a period known by one of the most terrific storms in English history. At other times we have a protracted season from a Mars position, which, culminating among a group of other positions from several signs, the combination and reaction have given rise to hurricane periods of the most destructive character. Of this we have an instance in the Royal Charter; while the great Black Sea storm of November, 1855; the Atlantic telegraph storm of June, 1858, and a host of others, with the singular rains and gales of the present month, testify to the reactionary influences of these Mars periods.

In judging of the weather, therefore, we have not alone

to judge of each position; we have also to estimate the effects of any combination or intensity of action by which any month may be marked, giving rise to a continuous period of coinciding influences, and consequent extraordinary season—circumstances under which the attractive force of a planet is of entirely different influence in inducing the reaction or storms usually resulting from the wane of culminating influences.

As will be seen, therefore, we have to deal with a somewhat intricate problem; yet, thus analysed, it is resolvable into very simple elements—the same principle of action and reaction, the same forces of "attraction" and "gravitation," of expansion and contraction, of evaporation and condensation, with their attendant phenomena, being visible throughout—whether in the protraction of a season, or in the brief and intermittent minor periods by which the greater is broken. Leaving more practical illustration of this to the review of following months, let us apply them to the purposes of observation in connection with the "meteorological influences" in September.

The month is influenced by five planets, Neptune, Mercury, Jupiter, Saturn, and Herschel, as denoted by the following linear diagram, A B of the path of the earth:—



The month is free from any combination of influence whatever, the relative motion of three months having sufficed to place an interval of eight days between the positions of Jupiter and Saturn, instead of the two days of June, Saturn having advanced from the 14th to 21st, Jupiter retrograding from the 13th to 11th. We may, therefore, obtain some favourable opportunity for the study of independent planetary influence, and the observance of weather probably

much in contrast to the present month. The only "irregular" position is that of Mercury with the sun, on the 7th; the last position, on July 1, being in combination with Neptune. In summer, the positions of Mercury add immense force to the action of the sun; hence, intense evaporation, high temperature, and often abundant and singular displays of cirri and cirro-cumuli. If extreme, the rapid cessation of the position gives rise to sudden storms of rain and hail, with thunder and lightning. In winter, though fine at times, the rarefaction of the air tends to the production of intense cold, followed by heavy gales at the close. As a developing position, it often induces a heavy storm period, as took place after Nov. 10, 1864. To those interested in the science, the present occasion may afford some slight interest.

From Neptune, on the 1st, we may probably witness some slight extreme of wind and rainfall, yet of only partial character, lasting the first two or three days; thence fine, dry, and rise of temperature till about the 8th, from which to 10th Jupiter will, no doubt, again develope some repetition of the reactionary influence of the last two positions. About the 17th a favourable change, as the earth feels the attractive force of Saturn's position. The reaction, together with the developing influence of Herschel, will most probably make nearly the remainder of the month changeable and unsettled to the close.

For stormy periods, I should look to the reactionary period from Mercury to the 15th, as the most continuous and extreme—the latter condition, of course, depending greatly on the previous development of this soli-planetary position. The next extreme I look for in the Herschel period, I should also look to the same periods (after 13th and 27th) for the low temperature of the month.

Of the two extremes, I should look for the low barometer with Jupiter, on the transition thereto of the 10th, closely

watching also from the 4th for any probable intensity with Mercury.

While pointing out, however, these positions for special observation, I am more inclined, looking at the two months' season reaction we have experienced, the freedom from the perturbing reaction of our present Mars position, and the absence of any intensity of combination, to look upon a favourable month generally as the most probable.

I am, Sir, your obedient servant,

FRED. PRATT, M.B.M.S.

Hackney, Aug. 25, 1865.

No. V.

THE METEOROLOGY OF AUGUST.

SIR,—This month again furnishes some singular features for the study of the meteorologists in connection with planetary position, as will appear by the following continuation of the tabular summary:—*(See next page).*

PRESSURE.—On comparison, the barometric curve will be found in very close coincidence with that of July. Under Neptune, we have the trough of the great wave of the Herschel position of July 25, marking a nearly continuous depression of 0·78 inch to the 31st and 2nd. From this latter it rises 0·44 inches to its "crest" on the 5th. From hence to the 22nd we have a series of minor oscillations, characteristic of reactionary forces, of which the positions of the 8th, 11th, and 14-15th, present instances of rapid elevation and depression. From the latter date, the curve becomes more regular, the oscillations giving place to a

		Bar.	Temperature.				Wind.		Rain.	
			Min.	Mn.	Mx.	R.	P.	F.	P.	A.
1		...	...	...	...	14	3	4·80	11	3·95*
2	—Nep.	29·75*	...	...	...	16	2	4·25	18	5·87*
3	..	...	44*	51*	58*	14	2	4·25	10	2·11*
4	...	...	...	...	...	18	...	3·00	2	·10
5	(x)	30·19†	...	...	...	24	...	...	...	...
6	...	...	...	...	...	20	...	3·45	16	4·86
7	...	29·92	58†	67†	76†	18	...	3·55	6	·94
8	Mars.	30·08†	...	...	...	19	...	2·30	3	·27
9	...	...	52*	62	...	20	...	2·50	7	1·19
10	...	...	...	65	...	20	...	2·65	18	7·61*
11	Jup.	29·67*	59†	...	68	9	1	4·45	16	3·92*
12	...	·94	...	62	...	17	...	...	...	...
13	...	·80	...	...	...	18	8	5·80	18	10·99
14	(x)	·92	...	64	73	18	3	4·55	16	7·07
15	(x)	·60*	...	...	68	13	10*	5·80	17	7·10
16	...	...	...	...	...	19	5	4·95	10	1·94
17	...	...	...	60*	...	17	6	4·90	9	1·51
18	Sat.	..	...	...	...	19	...	3·35	8	1·43
19	...	30·05†	50*	...	...	25	...	...	...	...
20	...	...	...	...	...	19	...	3·35	17	5·37*
21	...	...	...	...	...	18	...	3·00	9	1·97
22	(x)	...	57†	67†	77†	20	1	2·65	14	7·36*
23	...	29·55*	...	60*	65*	11	3	3·95	12	5·98
24	...	...	...	...	...	17	...	2·60	9	2·17*
25	...	...	...	...	...	20	1	2·95	4	1·04*
26	Her.	30·37†	...	65†	76†	25	...	...	...	...
27	...	...	51*	...	...	25	2	3·55	9	3·06
28	...	29·93*	58	...	...	13	...	3·35	12	3·18
29	(x)	...	...	59*	65*	12	1	4·10	8	·94
30	...	...	51	...	...	21	1	3·60	9	1·56
31	...	30·39†	...	...	...	19	1	4·35	6	·96
2	Nep.	...	57†	69†	82†					
							50	102·50	294	94·45

Explanation.—Bar. and Temp.: Periodic extreme readings, the elevations (†) and depressions (*) of the "waves" of pressure and temperature. R, daily range. Wind: Mean force of 20 places in Board of Trade returns. F.: Number of the 20 places "mod. gale," and over (*); days of coast warnings. Rainfall: A., amount registered at the number (P) of 20 places; (*) days of thunder, &c.

steady depression, and the minimum of the month, with the change to Herschel. Under this influence, the curve rises

rapidly and unbroken to the culmination, from which reaction ensues, causing another depression of 0·44 inches on the 28th. This the close position of Neptune immediately checks, and the curve then rises, forming the maximum of the month in a "crest" of 30·39 inches. The greatest range was that of Herschel from the 22nd to the 26th. The fluctuation of the curve showed a total of 5·62 inches, against 3·83 and 4·88 inches in June and July.

TEMPERATURE.—This is remarkable for an almost total absence of the great extremes of elevation and depression by which July was characterised. The only extreme was that of Neptune, under which influence the mean curve marked a fall of 21 degrees from transition to culmination, the position marking the lowest readings of the month. An unbroken rise of 16 degrees marks the change to Mars, from which the curve is upheld in a series of minor oscillations to the 17th. From that date a more marked influence is apparent in the greater range of curvature, observable as the periods culminate and change. The highest readings were those of the 7th, 22nd, and 26th, marking 76, 77, and 76 degrees. The temperature of the last period was excessive—26th, at Rome, 97 deg.; 27th, at Coburg, the *Times'* correspondent remarked, "so broiling, pitiless a sun, I hardly ever remember having to withstand north of the Alps; the intense glare made eyes and head ache." 28th, at Paris, "one of the hottest days of this year, 89 deg. at 3·30 P.M." The mean of the month marked 61·8 deg. against 64·1 deg. and 66·5 deg. in June and July, the mean daily range 18 deg. against 22·6 deg. and 19·7 deg.

WIND FORCE.—Under this head we have a sum total of the daily means of 102·50, against 94·45 in July, with gale forces at 50 places to 32 in the previous month. With the slight increase of 8·05 in the general force, we have the large increase of 56 per cent. in the prevalence of gale in-

tensities. Of the total, 39 places 43·75 force was produced on the 1st to 3d and 11th to 17th periods of Neptune and Jupiter; the heavy amount of 10 (of 20) places marking the close of the latter's reactionary influence. The mean daily force was 3·80. With the exception of these two influences, the daily force was generally deficient. The totals of August, 1864, were 43 places 93·85 force. Compared with this, the present month, with a rainfall of three times the amount, shows only the comparatively slight increase of seven places 8·75 force.

RAINFALL.—This is the most singular feature of the month, presenting the extraordinary total of 94·45 inches at 294 (of 620) places, against 142 places 31·77 inches in the same month of 1864. With the exception of January, 1865, (284 places 101·38 inches), it is the heaviest rainfall shown by these returns for the last 23 months. Of this total, one-half fell on the 1-3 and 10-15 days of the Neptune and Jupiter periods, and a further seventh with the transition to Herschel of 22-3. The total gives a daily mean of 9·5 places 3·46 inches. Compared by this, the reactions of period and position are equally prominent, the former in the amount of Neptune and Jupiter, the latter on the days of 6, 22·3 and 27·8. The returns of July were 219 places 56·26 inches. The present month thus shows an increase of 75 places 58·19 inches. Further evidence also appears in the following comparative table, showing the amount and distribution of rainfall of each planetary period of 1864-5, reduced to six-day means :—

Aug. 1864.	P.	A.	Aug. 1865.	P.	A.
Neptune, ...	32	9·52	Neptune, ...	62	21·02
Saturn, ...	35	8·13	Mars, ...	34	7·36
Jupiter, ...	10	2·01	Jupiter, ...	82	35·51
Mars, ...	8	·84	Saturn, ...	60	16·56
Herschel, ...	38	7·43	Herschel, ...	53	19·33
Month totals, ...	142	31·77	Month totals, ...	294	94·45

The elementary principles are here apparent—first, as to the irregular influence of Mars; and next, in the influence of change of position, as observed in the singular contrast afforded by the difference of position of Jupiter with respect to Mars in the two months.

For electric and magnetic phenomena the month was more remarkable than that of July. The first was the singular magnetic storms which prevailed from the 2nd to the 5th over Great Britain, and in widely distant parts of Europe. This storm is stated by the Astronomer Royal to have been one of the most violent he ever knew. Catania was again visited by two severe shocks of earthquake on the 19th, by which 64 houses were thrown down in Acis Reale. A shock was also felt all along the Mississippi on the 17th —slight, and doing but little damage. An aurora borealis followed the culmination of Mars on the 9th; and also accompanied that of Herschel on the 26th, along with a very vivid display of the zodiacal light. The transition of the 22nd, to the same planet, was also productive of some singular phenomena, several meteors being observed in the first two nights, followed by deluging rains, which, "over a great breadth of the Midland counties, and in other parts of England too, fell for nearly twenty hours in one continuous torrent, violent enough actually to split up plums upon the tree as if with a knife, and to raise in the valleys one of the deepest floods on record for this season of the year." Thunderstorms on nine days.

Beyond the facts thus furnished, the physical history of August is not a little remarkable from its connection with harvest, and the illustration which it affords of the nature and action of those presumable causes from which spring the singular exceptions and peculiarities by which those periods are often marked. In the elementary explanations of my last letter, I spoke of relative motion, its combinations and its

peculiarities, and the various extremes, intensities, and antagonisms resulting therefrom, more particularly as regarded the planets Mars and Venus, the nature and duration of whose influence and positions thus constituted them the arbiters of our seasons. It may, therefore, be both useful and interesting to give a brief analytical review of the somewhat singular summer of 1865, as explained by the philosophy of planetary position.

The first month of importance, for position, was that of April, as shown by our "linear diagram," as follows:—

[V]	H	(S)	J	N
15	16	17	19	28

This was a singular month, showing the first of the group of the irregular positions of Venus [V], with the passage of the earth between the sun and Saturn (S), along with a singular combination of position. Hence, the month was one great period of intensity—one of the most beautiful of spring months—very high temperature, and a rainfall of only 121 places 26·17 inches.

As a result of relative motion, May brought the following singular contrast:—

[M]	[V]	S[M]	JH	VN
8	8	15	18	31

Five positions, comprising three irregular influences; two positions of Venus, the first with the sun, the last with Neptune; Mars combined with Saturn, and Jupiter with Herschel. From this singular grouping sprang another beautiful spring month of heat and moisture, with extreme ranges of temperature. The rainfall marked 262 places 54·39 inches, the greater part falling between the 3d and 12th, and 22d and 29th days. The intense combination of 15 to 18 was marked by the Cape of Good Hope hurricane; that of the 31st by the Baltic storm, &c.

With a warm April and a hot and humid May, the face of the country was clothed with luxuriance, giving promise of a hay harvest of great abundance. June, however, brought the following singular changes:—

S(J)	(H)
14-15	21

A singular absence of positions, with Jupiter and Herschel in opposition. As the earth passed between these two planets, the three positions formed one period of extreme heat and evaporation. The rainfall marked only 91 places 27·46 inches, falling almost wholly on the first and last three days. Under this singular intensity, the grass dried up and withered, and the hay harvest thus became a general failure. With July, the scene again changed, under the following positions:—

[M] N	J	S	H
1	14	16	24

The 1st brought the intensity of a Neptune position, with the "irregular" solar of Mercury, along with the cyclone calamities of "Hong-Kong; the storms of the Indian Ocean, in which the "Orissa" steamer was disabled and driven back; and several other local hurricanes of great violence. Free from any other adverse influences, the month, though "reactionary," as following the previous protracted evaporation, was marked by high temperature, much evaporation, and extreme daily ranges, which, with the increase of rainfall to 219 places 56·26 inches, so stimulated vegetation, that hopes of an abundant and early harvest were entertained. So far as the influences were concerned, however, these hopes were not without their drawback, from the comparatively early period of the August Mars position, and the possibility of an immediate reaction after so extreme a Midsummer. On these positions the weal or woe of our harvest may be

said to depend. Thus in 1864, this Mars position appeared as follows:—

S	J	[M]	H	N
5	11	18	21	31

The first 10 days gave a rainfall of 50 places 10·63 inches; the next seven days, one place 0·01 inch; the next four, 13 places 1·62 inches. From this date reaction set in to the same position of September. To the end of August the fall marked 74 places 19·51 inches. The total was 142 places 31·77 inches; the last ten days, therefore, produced nearly two-thirds of the total. Following the dry July, this 20 days was of great advantage, enabling farmers to secure their crops in the finest possible condition—a most favourable circumstance, as September proved a reactionary month of great extreme, the rainfall marking 258 places 74·20 inches, in continuous rains, to the 23d, with 16 days of thunder, &c.

Returning to the present period, we find the following comparative positions for August:—

N	[M]	J	S	H
2	8	11	18	24

the position of Mars being ten days earlier than that of 1864. It was, however, protracted, the earth being within six degrees of position so early as July 22. Combining with Herschel, the reaction of that month was arrested, and remained almost entirely suspended till the 31st, when Neptune again illustrated the truth and precision of the philosophy by producing reaction, and giving rise to a rainfall of 54 places 19·67 inches to Aug. 3. The evaporation of Mars then resumed sway, and remained in force till the 10th, when the transition to Jupiter gave one-third of the downfall to one-fifth of the month.

To the superficial observer the influence of Mars would appear to have been entirely nugatory. On the contrary, to

the presence of this position we are indebted for a period, or season, of a most singular character. Apparently overborne, it still continued to hold most remarkable sway over the subsequent reactions, obliterating the great oscillations of temperature of July, maintaining a nearly equal daily range, and thus sustaining evaporation. From this singular counteraction, the otherwise disastrous amount and prevalence of rainfall became an element of positive good, compensating for a moderate amount of damage to cereals by a richness and abundance of aftermath and root crops, of present and winter "feed" for stock, not experienced for several years.

In place of the arid and barren aspect of nature in 1864, the pastures were covered with the freshness and verdure of spring, and teemed with a luxuriance of vegetation sufficient, in comparison with the failure of 1864, to more than compensate for the evil and destruction of the cattle epidemic. Had the positions been accompanied by that of Venus, as in 1860 with its ruined harvest, or in 1846, when the potato crop was destroyed, the consequences would have been indeed serious. We may thus see how much we are indebted to the accidents of planetary position.

It is difficult, of course, to do anything like justice to so vast a topic as the philosophy of the seasons. Coupled with the few principles I gave in my last, I trust the illustrations I have here given will suffice to show the same connection between these periods and the irregular occurrence and grouping of the planetary positions, as appear between the angular positions and the extremes denoted by the tables, and thus afford that practical clue to the knowledge and appreciation of a wisdom and providence in creation which we have hitherto failed to obtain from any other philosophy.

I am, Sir, your obedient servant,

FRED. PRATT, M.B.M.S.

Hackney, Sept. 6, 1865.

No. VI.

MONSOON INFLUENCES IN 1865.

SIR,—Looking at the positions for October, I find the occasion peculiarly favourable for still further illustrating the principles I have laid before the observer in my last two papers on the effects of the relative motions and positions of the planets upon the seasons and months. Beyond this the month will also afford us an opportunity for studying the influence of a planet I have hitherto only made known by reference. I allude to the planet Venus, a generator of some of the most violent and protracted vicissitudes, as well as a cause of some of the most serious misfortunes which mark the history of human welfare. It is the last of the three "irregular influences," the peculiar effects of which I have already adverted to in my late papers, and of which the observer has already had instances in the generation of the violent thunderstorms, etc., of Mars and Mercury, on the 10th and 9th days of August and September last.

To the investigation of causes the ensuing period is of still greater interest, from the remarkable occurrence, within a period of 21 days, of positions of all three "irregular" planets, two of them besides in solar conjunction—a singular and rare succession of causes for an equally singular autumn.

The only approach to such a period was that of October, 1863, when the positions were as follows, the brackets showing the "irregular," the parentheses the "solar" position:—

([Ms.]S.)	x	([My.])	x	H.	[V.]	N.	(J.)
2	6-7	11	14-15	18	21	28	31

Added to these positions, on the previous 28th Venus was in solar conjunction, Neptune in solar opposition—the

earth, therefore, in a line with the three orbs. So that, in five days, the earth ran the gauntlet of the combination of four planets with the sun, and memorable were the effects. With the change of Oct. 6 took place that violent shock of earthquake which spread consternation throughout England. The rainfall of the month marked 99·68 inches, and coast warnings were issued for 17 days; while from all parts of the world the record was one continuous detail of inundation, wreck, and disaster. 14th, in Virginia—"A more fearful night seldom seen in any climate; the rain, which had scarcely ceased for three days and nights, descended as though the flood gates of heaven were opened, along with a tremendous storm of thunder and lightning." 18th, with Herschel at the Cape—"A terrible storm at Port Beaufort. Hail as big as hen's eggs. 400 beasts killed on one farm. Never such weather, such scenes, such injuries!" In Australia—"Never have the rivers risen during the preceding 12 years as they have risen during the last few weeks of October." In London, 30th, a singular cyclone, the barometer marking 28·86, from 30·32 on the 21st, and force of wind greater than for the last 20 years. At the Cape, also, on 28th, "barometer lower than for a long time previously." In Great Britain, thunderstorms, &c., on 15 days, of which the 7th to the 14th, or Mercury period, were one unbroken succession.

But perhaps the most remarkable illustration of the effects of these congresses of the "irregular" influences, is that afforded by the "monsoon" period of October and November last. October presented the following positions:—

(N)	x	[Ms.]	S	x	HJ	N
30	5	10	14	18	22	28

On Sept. 24, the sun and Mercury were in conjunction; on the 30th, the earth passed between the sun and Neptune;

on Oct. 10, it met the irregular position of Mars; 14th, that of Saturn with the sun; and 15th, the double position of Herschel and Jupiter—a concentration of soli-planetary action of the most intense character. In England, after a rainy September (270 places, 74·20 inches), the rain finally ceased from the 24th, with the close approach to Mars, and was upheld till the earth passed beyond Saturn and the sun. Reaction immediately set in, and culminated in a most violent intensity on the 21st, giving a fall of 9·58 inches at 20 places, followed by a further fall of 11·71 inches at 16 places in the next two-day return. The total of the month's Board of Trade returns gave 164 places 57·01 inches, of which the first 14 days gave six places 1 inch; the next 14 days, 154 places 55·45 inches! The record of disasters was fearful. As a result of the reaction of the two "solars" of September, the transition of the 5th brought the fearful cyclone of Calcutta, which in 24 hours destroyed 100,000 lives, and made an utter wreck of the city and the large fleet of shipping in the ports, of which only 23 escaped out of 195. On the 10th (with Mars), a hurricane and thunderstorm passed over Rio Janeiro, which, lasting only 15 minutes, did damage to the extent of £550,000, the barometer giving no indication of its approach. In England, the reaction commenced on the 18th, and culminated in a "great storm" all over the kingdom, lasting from the 19th to 22nd. In Wick Harbour, the works were almost wholly swept away by its fury, whilst in other parts of Scotland the rivers were in higher flood than since 1829. Such are a few examples of the effects of Mars' reaction. November came, with the following remarkable positions, as the result of relative motion:—

x	[Ms.]	[My.]	[V.]	S.	H.	x	N.	(J.)
2	8	10	11	16	20	24	28	30

Here, again, was a concentration of the three irregular influ-

ences, under the evaporative intensity of which rainfall and wind force were comparatively suspended till the 12th. The first 11 days' returns marked 27 places 3·32 inches; the double return of 12-13th, 16 places 9 inches! The total of the month marked 247 places 85·53 inches, of which 220 places 82·21 inches in the last 19 days testified remarkably to the reactionary force of this singular concentration of irregular positions. The barometric extremes were the most singular feature, the readings on the 6th marking 30·62; 8th, 30·16; 9th, 30·21; descending under Venus to 29·87 on the 12th. On the 14th it marked 28·77, and, after a series of oscillations, finally reached 30·02 on the 21st. From this, with three oscillations, it again fell to 28·85 on the 25th, finally recovering to 30·43 inches on the 29th. The total fluctuation was 10·71 inches. Of gales at 141 places, 138 appeared after the 11th, along with coast warnings on 17 of the 19 days. On the 2nd, the transition to Mars again developed a repetition of the cyclone at Masulipatam, in which 5000 natives perished, and the native town was washed away. At the same time, France was suffering severely from inundations, while in Spain several towns were almost entirely swept away. A singular magnetic storm marked the 16th, the Greenwich and Croydon magnates showing a state of violent oscillation. The transition period of the 24th was memorable for its "night of horrors" on the Black Middens at Shields; and the month, from the triple culmination of the 11th, was one continuous record of wreck and disaster over every part of the coast of the United Kingdom.

Such a concentration, fortunately, is of but rare occurrence. I am not, therefore, producing these illustrations for the purpose of alarming the reader as to ensuing period, but to show by what influences these otherwise inexplicable disasters are really produced, with the view that, being more properly understood, some at least of the terrible sacrifice of

life and property may be averted by their study in the future. With this exposition of their causes, all to whom the subject is of interest or worth will now be enabled to observe and study with practical effect the progress and development of what may be termed THE MONSOON PERIOD OF 1865.—Commencing with October, we find the influences to stand as in the following linear diagram of that portion of the earth's yearly course:—

N	x	J	([My])	[V]	(S)H	N
1	9	18	21	23	26	31

Compared with September, we here find some considerable displacement of position, the relative motion of the earth and Mercury removing the "solar" of the latter from the 7th to the 21st. The position of Jupiter is also carried forward from the 13th to the 18th, thus leaving a large portion of the month free of any great disturbing causes. Passing the intense solar of Mercury, the period then becomes one of singular concentration. For the first time since May, we approach to angular position with Venus, closely from the 1st, and culminating on the 23rd. On the 26th, we pass the the sun and Saturn in conjunction, combined with Herschel; the month closing with Neptune. We cannot, however, understand this singular period without reference to November, which brings the following positions:—

X	([Ms])	x	J H	S N
5	11	17	24-5	29

The most remarkable of which is that of Mars with the sun —a most powerful position, within 6 degrees of which the earth continues from Oct. 22 to Nov. 30. In the latter portion, the effects of relative motion again manifest themselves in the displacement and combination of the four extreme planets,

Such are the positions and influences which characterise the close of the remarkable year 1865. Compared with 1863 and 1864, the difference in the diagrams will be at once discernible in the contrast of the position of Mars with respect to those of Mercury and Venus—a sequence of position which, by counteracting and retarding the influence of the two latter planets, will be the cause of some well-marked and favourable contrast, and subsequent reaction, equally illustrative, with the year, of the philosophy of the seasons and the astronomic law of storms.

Let me now proceed to direct the attention of the observer to the salient points and probable effects of the period—a task, this time, not without its difficulties, from the mutually-balancing influences by which it is characterised.

Entering October with Neptune, we may look for a more general prevalence and intensity of the partial gales and downfall which characterise this influence—here more powerful, as the probable close of a greater reactionary period, as well as coinciding with the close angular position of Venus. Progressing to the transition of 9·10, a more favourable change, leading to a fine period, as the earth feels the influence of Jupiter, the reactionary tendency of which the close position of Mercury with the sun will do much to counteract. From Mercury I shall look for some moderate repetition of his September influence, in elevation of temperature and geniality, till conjunction, followed immediately by some stormy reaction to 22·3. The close solar of Saturn may, however, tend much to counteract the reaction of both Venus and Mercury, in which case I think the 26th will hardly pass without the occurrence of storms of some violence, with heavy downfall, ameliorating as the month closes.

I may, in fact, characterise the period from the 21st as one of great hazard, more particularly should the pre-influence of Jupiter and Mercury conduce to much evaporation. In

that case, the subsequent period would be one of great intensity, with some storms of great violence between 23rd and 28th. Fortunately for the present period, however, on the 22nd the earth will be within 6 degrees of exposure to the combined influence of Mars and the sun—one of the most powerful positions of that planet, the effects of which, occurring in July, 1859, made that summer so remarkable for its heat and drought. It may therefore do much to counteract the humid and stormy tendencies of Venus, and thus limit the reaction to the culminating positions which mark the period.

Entering November, we have a repetition of the October protraction of influence, in the extension of the Mars period over the first 17 days. With the remembrance of the analogous influence of December, 1863, I think we shall witness some remarkable protraction of the autumn period, beneficial to agricultural operations temperature in excess for the season, along with suspended rainfall. If much in extreme, we may look for immediate reaction in probable thunderstorms and heavy rains to the 18th. Some remission to the 23rd, followed by stormy weather to close, heavy gales and rains marking the two double positions. From the relative motion of the earth and Mars, the position will be within 6 degrees limit to the close. As a possible consequence, the condensation may be but partial, giving rise to much fog or dense heavy atmosphere to the 17th, succeeded by a very stormy reaction to the end.

Such are the influences and probable effects of the monsoon period of 1865. As one of the most important meteorological periods of the year, it is equally worth the study of the philosopher and the care and caution of the mariner, as the examples given demonstrate. The subject of causes has never before been entered upon; I have therefore gone somewhat into detail, that it may be properly examined and

understood, with the view to some practical and useful results. In the judgment at which I have arrived, there may ultimately be found some erroneous conclusions, arising from the difference in the position of Mars as compared with the periods of 1863-64. Still, having pointed out the possible contingencies, as well as the exact points of influence, the observer will have no difficulty in forming an independent judgment of the probable intensity of any period. In this he will receive valuable assistance from his barometer, the indications of which, in connection with the positions, will give him a facility of comprehending the intensity and duration of a period afforded by no other system. I can only briefly bid him beware a "high barometer and fine weather" with the culmination of any position, and more especially with those of Mars, Venus, or Mercury, or any concentration of influences whatever, as in October 21 to 27, November 11, 24, and 29. Let it be remembered that no reaction can be universal—that the storm of one region makes the calm of another, the deluge of one locality the clear sky and evaporation of a more distant. The indications of the "glass" will then point out not only the possible extreme in any part of the world, but also the period of its commencement or termination. Could only this one feature of the science be practically known and appreciated in navigation, such calamities as those of the Royal Charter and the late Hong Kong cyclone might, with the exercise of a little reasonable care and forethought, be rendered almost a rarity. As it is, we are yearly allowing the lives of hundreds of brave men to be uselessly, cruelly sacrificed to the craven fear of being pointed at as astrologers and prophets, for having recourse to a philosophy in every respect in harmony with the wisdom and providence of creation.

The following affords a remarkable instance of the value of such a working philosophy:—In Jan., 1848, the positions

bore some close resemblance to the ensuing period, marking thus :—

(S)	N	[V]	x	(H)	(J)
7	8	10	12.13	15	25

The earth in four days being exposed to the solar conjunction of Saturn, along with the position of Neptune and Venus, following a still close Mars position of December. The following weather was recorded :—"The close of 1842 was as mild as it sometimes is with us in the month of May, the mean of the thermometer for December being 47 degrees; barometer on Jan. 1, 30 inches. Mild and generally quiet weather followed till the 12th, when at 2 P.M. the glass stood at 29·90, and at 9 o'clock at 28·40, being a range downwards of 1·50 inches, and this in the course of seven hours, when one of the most destructive hurricanes on record took place. The evening of the 12th was calm—not a breath of wind. The moon shone out through a thin vapour of fog, with a beautiful halo of large dimensions around her; and on the 13th, at 4 A.M., the hurricane was raging in all its fury, which continued to sunset, accompanied with snow and sleety showers, wind S.E. Painful, indeed, it is to reflect on the effects of this hurricane. Looking at the list of casualties, I find 180 vessels were lost on the coasts of Great Britain and France, and above 480 valuable lives perished in the raging ocean, and property to the amount of half a million destroyed, on this terrific day. This hurricane ravaged the greater part of the Netherlands and the north of France, from lat. 45 to 60. The writer, a "Planetarian," then adds the following practical testimony :—"I wrote to a friend of mine, having an eye to these compound aspects (he was returning to a Scottish port in ballast), to secure his ballast before starting. I copy his answer in his own words, —"I thank you kindly for your friendly advice. Had I

not done as you requested, not a soul of us could have told you the tale. I was overtaken on the east coast of England. In a few hours the sea ran mountains high. Had the ballast shifted, we would have foundered, but, being well secured, our little bark rode bravely out—nay, weathered the gale. The wind was S.S.E., and the day previous (the 12th) there was a great fall of the barometer. I, for one, wish well to the science of meteorology."

We have now progressed to a better knowledge of these influences and their action. Let any one look at the indications of the linear diagram, and compare them with those of 1864. A feeling of regret must pervade him to think how many of the "500 valuable lives" might have been saved by the application of a little knowledge, the delay of a few hours, and the monitions of the barometer in coincidence with "irregular" position.

I am, Sir, your obedient servant,

FREDERIC PRATT, M.B.M.S.

September 23, 1865.

No. VII.

WEATHER INFLUENCES IN DECEMBER.

SIR,—In the brief half-year during which you have permitted me to hold intercourse with your readers, we have travelled together through strange and varied scenes in the domains of meteorological science. From the positions presented by the linear diagram for the ensuing month, I think that 1865 will not pass away without a still further illustration of the singular extremes by which the science is characterised. The orbital positions are as follows, the line describ-

ing the December portion of the earth's orbit, intersected, interiorly and exteriorly, by the ray or influence of the planets at the periods denoted by the dates beneath:—

x	(H. My)	x	N	(J)S
11	23	27	29	31

These positions are remarkable, as affording a still further illustration of the peculiarities arising from the difference in the relative motion of the earth and planets. In our present month (Nov.) we have seen the earth for 17 days under the influence of one position—that of Mars with the sun. We have seen the beneficial results of this in the economy of creation, the production of an almost uninterrupted fine and dry period for the important operations of seed-time. We have only to look back to the few previous days of October, with the present days of November to fully appreciate its value to human welfare. Looking at the above diagram, we find this isolation of position still further developed in December, the only point of influence being the "transition" period of the 11th, thus leaving upwards of 20 days free from any primary disturbing influence.

Such barren periods are of comparatively rare occurrence. The most notable is that of February, 1855. In that year, positions of Saturn, Jupiter, Herschel, and Neptune marked the 29th, 30th, 1st, and 3rd days of January and February. The next position was that of Saturn, on Feb. 28. For 24 days, therefore, the earth was free from any influence, save the "transition" of the 16th, and the sun and moon. The effects of this gave origin to one of the most remarkable periods of modern history. Describing the month, one of our oldest meteorologists wrote:—"We have just ended not only the coldest February I have ever recorded, but the coldest in the memory of the oldest man. There are no perfect registers earlier than 1771, and since then, during the 84 years, no February has been so cold as the present."

With one slight ascent of 8 deg. on the 12th, the curve of mean temperature fell from 35 deg. on the 5th to 17·5 on the 18th, recorded by Whistlecraft as "the most violent frost in England for 35 years. The thermometer at 8 A.M. stood at 1·5 deg., or 30·5 deg. below freezing. The like has not occurred before since Jan. 15, 1820."

Thus much for solar influence, in the absence of planetary position. In illustration of the "temperature" question, I may further state, that from this mean of 18·5 deg. the temperature immediately rose as the earth progressed to the Saturn influence of the 28th. Without further break it rose to 43·5 deg. on the 25th, receded to 35·5 deg. on 27th, and closed at 47 deg. on March 2nd, the influence of position thus developing 28·5 degrees of temperature in 12 days.

These facts will afford an idea of the general nature of the influences in the earlier portion of the ensuing month. As a contrast to these, the next position is one of singular intensity, of which the following diagram will afford a better idea :—

(Her.).....(Earth).....(Mer.)..(Sun)

That is, that on the 23rd December the earth will be so situated as to be passing between Herschel and Mercury with the sun, as shown above, and the whole of the orbs nearly in a straight line, forming a position of singular intensity. In my own brief experience I know of no position of a similar nature, save that of the earth's passage between the sun and Herschel on Nov. 23-4, 1858, the solar irregular of Mercury being superseded by a position of Venus on the 22nd. As a consequence of that intensity the cold of the period was most remarkable, the night of the 23rd being registered by Mr. Glaisher as "the coldest night for 32 years;" and the two days (22-3) as the "coldest consecutive days within record." As a contrast, at Sydney the maximum of the 24th marked 99 deg. (from 76 and 86 deg. on 22nd

and 23rd), the 25th marking 68, or 21 deg. below! The 24th marked the extremes of mean temperature of both places—in Sydney of 74 deg., in London of 25 deg.; followed by an equally simultaneous reaction and extreme on the 26th, in Sydney of 61 deg., in London of 52 deg.

Of this intensity the effects upon the public health were the most remarkable feature, the deaths in the four weeks in London marking 1217, 1349, 1487, and 1802; the latter, or "Herschel" week, being recorded as 400 above the average—"scarlatina, bronchitis, and pneumonia raising the deaths nearly 500 above the average" of the subsequently-registered similar week of 1860.

As illustrations of the planetary philosophy and its application, these examples are of great interest, and the more so from the fact that, in the present state of meteorological science, we are left without any clue whatever to the nature or causes of such periods and their phenomena.

With this brief review of similarly-influenced periods, let us now pass to their probable action in December. Taking the first ten days, the close of the Saturn-Neptune period, I deem they will more likely be marked by the occurrence of unsettled weather, with intermittent storms of wind and rain, as the effects of those influences, waning as the period closes. Such appears more probable than any extreme of cold. Passing over the "transition" of the 11th, I think we may then look for the setting in of a more dry, evaporative period, as the earth gradually experiences the rarefying influence of the following double position. With such an inauguration, the period will then be one marked by some notable depression of temperature, generally dry and frosty, reaching to some considerable extreme about its Christmas culmination. With such an extreme, the duration will be but brief, yielding to the 27th, with rain or snow, and strong winds. Passing this point of its orbit, the earth will then

come under a powerful combination of influences, composed of Neptune, Saturn, and the conjunction of the stormy Jupiter with the sun. As following a period of probable marked severity, the closing days will witness the occurrence of heavy storms on the coasts, &c., in their greatest severity as the earth passes Jupiter and the sun on the 31st. They will also be accompanied with heavy falls of rain or snow, according to locality.

Of the storm periods of the month, this latter appears to me the most probable for intensity, as well as for the greatest barometric disturbance and contrast of temperature. A minor period may probably be observed about the 11th. Ordinarily, the positions of the 23rd are of an intensely stormy nature; but those effects will on this occasion most likely be felt in more southerly latitudes, giving rise to a high degree of rarefaction, and consequent disappearance of temperature in these and higher parts of Europe. With such an influence, the rapid cessation of the attractive force of Mercury will give rise to probable immediate atmospheric condensation, with its attendant elevation of temperature, storms, and downfall. The 29th to 31st will then be the period of greatest violence, from the combination of the cyclonic storms of the previous influence with the periodic action of Jupiter and Saturn.

As the pivot of the month, there is, as a phase of planetary influence, the probability of some development of temperature to the 23rd, followed by storms, and culminated with the intensity of cold under Jupiter and Saturn. But this would be the consequence of a cold reaction from the Saturn-Neptune positions of Nov. 29 to the "transition" of Dec. 11—a contingency I do not deem probable. Under Mars, without any particular extreme of elevation, we have up to the present time experienced a remarkably sustained mildness of temperature. The earth is now passing rapidly

beyond angular distance of this planet; and, once fairly in December, I have no doubt we shall experience a contrast that will be worth the observation and study of all who take any interest in weather science.

I am, Sir, your obedient servant,

FRED. PRATT, M.B.M.S.

Hackney, Nov. 21, 1865.

No. VIII.

THE LAWS AND PHENOMENA OF THE WEATHER IN OCTOBER.

SIR,—Looking at the hopeless condition of Meteorological science, as disclosed by the recent report of the Government Committee of Inquiry into the operations and results of our "Meteorological Department," it may appear somewhat of presumption to talk of the "laws" of weather. But I think it will be evident already to many of your readers that the fault or weakness is not so much that of the science as of the ill-founded theories on which it is based. With the conviction of this fact as the result of several years' investigation and research, I could not forbear once more entering upon the exposition of the weather and its "laws," with the view of endeavouring to rescue so noble and useful a science from the reproach thus unjustly cast upon it.

From its intimate connection with national welfare, the prevalence and amount of rainfall has ever been the leading feature of meteorology, and the most minute and elaborate experiments have been made for the discovery and determination of the laws and principles by which it is governed. The effort has been fruitless. I thought, therefore, that I could not do better than take up this subject—now, unfor-

tunately, so popular—and, explaining the past of 1866, proceed to test the principles by reference to the future, in connection with some singular phases of planetary position. Of October I spoke as remarkable for the recurrence of the irregular position of Mars, and its probable effects upon the dryness and rainfall of the month. I think I may now usefully lay the computed results before your readers, reproducing the positions, that the details may be better understood :—

	H.	My.	S.	N.	Mars.	x	J	x	
A									B
	1	3	4	5	8	11	17	24-5	

In connection with these, we have the following table, taken from the daily returns of the Meteorological Department, showing the—

COMPARATIVE PREVALENCE AND AMOUNT OF RAINFALL IN TWENTY PRINCIPAL PORTS OF THE UNITED KINGDOM DURING OCTOBER, 1866.

Date.		Places.	In.	Date.		Places.	In.
1	Herschel,	... 2	.10	17	Jupiter,	... 11	... 3·14
2	,,	... 7	·16	18	,,	... 12	... 3·56
3	Mercury,	... 3	·52	19	,,	... 6	... ·31
4	Saturn,	... 5	·26	20	,,	... 16	... 3·88
5	Neptune,	... 2	·03	21			
6	,,	... —	—	22	,,	... 10	... 2·51
7				23	,,	... 4	... 1·05
8	Mars,	... —	—	24	,,	... 19	... 4·84
9	,,	... —	—	25	Transition,	... 6	... 1·88
10	,,	... —	—	26	,,	... 10	... 1·81
11	,,	... 3	·15	27	,,	... 15	... 3·00
12	Transition,	... 4	·38	28			
13				29	,,	... 7	... 2·03
14	,,	... 16	3·20	30	,,	... 12	... 1·70
15	,,	... 2	·06	31	Herschel,	... 6	... 1·69
16	,,	... 2	·57				
				Total of period,		...134	...31·35
Total of period,		... 46	5·48				
				Total of month,		...180	...36·78

Analysing this table, we obtain some singular results, illustrating very forcibly the laws of rainfall and the philosophy of the seasons. Taking the totals of 540 observa-

tions, rain was registered in 180 to the amount of 36·78 inches. In the same month of 1865, influenced by the humid planet Venus, rain was registered in 330 observations to 140·43 inches; thus showing a deficiency for 1866, as the different results of the two influences, of 150 places, 107·65 inches. Thus much for the influence of Mars on the month. Let us now take the periods. For the influence itself, the absence of rain all over the kingdom for five days will suffice. Its power as a counterbalance to that of other planets is shown by comparison of the first five days of each column, which give totals of 19 places 1·07 inches, against 45 places 10·89 inches, or a ratio of 10 to 1. Comparing the 11th-16th and 17th-22nd days, the upholding influence is further shown by totals of 27 places 4·36 inches, against 55 places 13·40 inches under Jupiter, or a ratio of 3 to 1. Further evidence of "law" is shown by the columns—the first, under Mars, giving a total of 46 places 5·43 inches, to the 134 places 31·35 inches of the latter, or reactionary period, developed by Jupiter, the influence of which is still further shown by the comparative totals of 1st-12th and 13th-31st days, in which the ruling of Mars gives 26 places 1·60 inches, that of Jupiter 154 places 35·18 inches, or a ratio of about 22 to 1! The following shows the daily mean of each period:—

Periods.	Places.	Inches.	Periods.	Places.	Inches.
Herschel, &c.,	... 4	0·19	Jupiter,	... 8	1·98
Mars, ...	... 1	·08	Herschel,	... 8	2·01
Mean,	... 2·5	·13	Mean,	... 8	1·99

These figures show sufficiently the influence of Jupiter as a "determining position," to which alone the reaction is really due. The last recurrence of the Mars position took place in July, when the positions stood as follows:—

A	N	x	M (J)	x	H. S	B
	4	12	19-10	25	29	

Mars being conjoined with the conjunction of the sun and Jupiter. As the result of this influence, in the first 16 days from the 9th to the 25th the tables of the Meteorological Department give a return of 88 places 7·10 inches of rain. With this transition came a sudden change, the results of which, in the next 16 days, were denoted by a total of 187 places 55·88 inches, or an excess of 149 places 48·78 inches as the effects of the determining influences of the Saturn-Herschel position. The period was also much commented on for its remarkable phenomena of thunder and lightning, rain, hail, and ice storms, which swept over the metropolis, as well as over a great portion of England, causing the loss of several lives, and inflicting much damage upon every description of produce.

Such is the simple "order or method of nature," the lucid and practical "law" of drought and rainfall, developed by the astronomic philosophy, as opposed to the pointless, impracticable rules of our present science, evolved from the study of monthly "means" and totals, and their deduced "elements." For seven years these "elements" have been on their trial, with every formality and resource at the command of science. With what results? A verdict of condemnation from the Government Committee, from their incapacity to furnish a single practical rule which could be left as a guide to succeeding meteorologists. That the verdict is erroneous, the facts contained in the above table, from their own "latest returns," is the best evidence. The fault lies in the theory, not the facts.

Passing to other features: As regards the barometer, the month showed a high reading, of which the maximum (30·56) occurred on the 7th, under Mars' influence, and the minimum (29·69) with the close of the Jupiter period, on the 25th. One greater wave marked the overlying Mars' period, having the 1st and 13th days for its base or "trough." At

this latter date reaction set in, under Jupiter, giving rise to lesser waves but more rapid oscillation; two depressions or "troughs" marking the 18th and 22nd, followed by the greater minimum at the close of the period on the 25th. Hence the curve made a rapid rise of 0·7 inches to the lesser maximum (30·47) of the 29th, to be immediately depressed to 29·80 on the 30th.

In response with these indications were the storm periods of the month. Under the sustaining influence of the Mars period the daily mean of the wind force at the 20 ports was lower than for many months past; the prevalence of the gale force of "7" being as 1 to 260. On the 15th the prevalence was as 1 to 10. On the 16th, with Jupiter, it was as 1 to 2·5, with a doubling of the mean force, and the highest of the month. The influence of the position was also shown by the issue of storm warnings to the coast on the 17th, as well as the prevalence of the gale force in 17 of 80 places during the 16th to 19th days, or a ratio of 67 to 1 as compared with the previous period of October. The 28th to 30th days were also marked by the prevalence of one of the transmitted storms created by the change to Herschel influence.

The most valuable evidence of "astronomic" law, as regards the development, prevalence, and correlative phenomena of these storm periods, was that furnished by the group of influences by which the first few days were marked. As anticipated, their effects in this quarter were almost *nil*, save in the prevalence of a period of calm beyond any recent experience. But from that portion of the Atlantic bounded by the coasts of north America, tidings of a different nature have since reached us. Sept. 28 to 30 were marked by heavy hurricanes, which, after a slight lull of a few hours, were succeeded by "one of the most severe storms that has visited the coast of Georgia for many years, and which

caused more marine disasters than have taken place for some time." Six steamers were lost in this hurricane, among them the "Evening Star," the details of which are already too familiar. These gales continued to the 6th, disappearing, under Mars' influence, till the 11th and 12th, when they again appeared, accompanied inland with a terrible rain storm, the reaction of Mars, "which has extended over seven States, and done incalculable mischief. Several persons have been drowned; dams, bridges, and houses swept away; the streets of cities and towns inundated, and thousands of farms covered with water!" Turning to our own coasts, we have all this violence and condensation finding its compensation in a period of calm, dryness, and excess of barometric pressure beyond long experience. With all this apparent calm, yet both the atmosphere and earth were in a highly excited state. On the 4th, the telegraphs on our east and north-west lines were disturbed by "earth currents," followed next day, as the earth passed between the sun and Neptune, by a shock of earthquake in Devonshire (the opposite position of the earth to this planet, on March 19, 1861, was marked by an earthquake at Mendoza, in Chili, which killed 12,000 persons in six seconds), and the appearance of auroræ in Scotland.

This singular diversity of condition in the two hemispheres in connection with the astronomic law of storms is the more noticeable from the objection made to this theory by the late Admiral Fitzroy ("Weather Book" chap. 1), that such reactions, if true, "should affect the earth in entire zones." This objection, however, is disproved by his own theory. Philosophy will tell us, and fact will confirm it, that no reaction was, or ever can be, universal. Planetary attraction may, by intensity and combination of position, so rarefy the atmosphere, as, with the sun, to cause a more or less serenity over the entire globe. But, passing that orbital point of in-

fluence, the force ceases, and rarefaction disappears, causing the air sphere, under the now superior force of gravitation, to become condensed, setting free the vapour held in solution, along with the heat rendered latent in its evaporation. Continued, this process would gradually bring the excess of moisture back to the earth as rain, by precipitation. But in this over-charged state of the atmosphere, other forces, as of chemistry, &c., come into play. From local attraction, from the pressure of counter-currents of colder air, or from the extreme pressure of condensation, the affinity between the heat and moisture of pre-evaporation is suddenly destroyed, and reaction sets in over an area of more or less extent. Did the atmosphere, following the sun, travel equatorially, this area of reaction would also travel in the same way, and thus produce a zone of storms. But this it does not, but, obeying the counterbalance of the terrestrial forces, as shown by Maury and others, progresses in an angular direction towards the poles, and *vice versa*. It is evident, therefore, whatever reaction takes place must obey the same law, and a zone of storms is impossible of existence in nature.

Let us apply this to this Atlantic reaction. A crowd of influences concentrate their forces upon the earth the first five days of October. As the result, we have September closing with "mild and agreeable weather, with now and again slight breezes, more refreshing and pleasant than uncomfortable or threatening." With the 1st, the first position, that of Herschel, was passed, and with it came the reaction induced by local circumstances:—"The clouds looked gloomy, sails were taken in, and every preparation made for the coming storm, which now to even an experienced eye seemed inevitable. At last, towards midnight, the dreaded hurricane burst upon the trembling ship. The fury was fearful, terrific, and appalling. At daybreak on the 2nd, the storm still there, and continued with remorseless force

all day. At 6 A.M. of the 3rd, on came one fearful gust, disturbing the waters with fearful violence. One heavy sea strikes the hull, and all is over with the 'Evening Star,' and all on board."

A similar storm was, at the same time, sweeping over the Island of New Providence, thus described:—"The destruction done is fearful in the extreme. The scene on shore was terrible. More than half of the town of Nassau is in ruins. Most of the houses have been unroofed, many blown to pieces, and some moved bodily from their foundations into the streets. Churches, warehouses, and buildings of solid stone are shattered as if by a bombardment. The trees are destroyed, leaf and branch, as if by a conflagration. Of some hundreds of vessels the day before in the harbour, not a single one remains; wharfs and the commissariat and dockyard piers down, and all the stores, sheds, and outbuildings in both places destroyed. The fury of the wind was indescribable, and the roaring of the sea and the shrieking of the wind fearful." 617 dwelling-houses were destroyed, 609 damaged; 93 vessels and boats destroyed, 97 seriously damaged, 41 slightly injured—total, 231.

Such are the characteristics of the storms coincident in many parts of the world with this addition of Mercury to the sun, from one of which, combined with positions of Saturn and Herschel, on May 6, 1862, a hurricane swept through a portion of Nottinghamshire with a force that drove the hailstones in clean holes through the glass. From the violence of their reaction, the area of these storms is very limited, and often no warning of their approach is given by the barometer. It is only when combined with other positions, as in the present instance, that their duration becomes more protracted and their area more extended, at the same time that their action and influence are manifest by the development of correlative, yet diverse, phenomena over a greater

portion of the hemisphere, as is shown here by the slight rainfall of the first five days compared with the following, the retardation of the barometric wave, the disturbed magnetic condition of the earth and atmosphere, and the resumption of the rainfall with the same date of the rainstorm before noted at Washington. Overborne by the overlying influence of Mars, the reaction, though great, was circumscribed in its prevalence, travelling meridionally, no doubt, and absorbing in its vortex the free electricity and moisture of the adjacent air sphere. Hence the prevalence of those opposite conditions of weather which alike baffle the inductions of science and the speculations of prophecy. The knowledge of their times and laws forms the best safeguard.

Following Mars, the next reaction presented features of an entirely different character, from the absence of any overlying force to rarefy the atmosphere and sustain evaporation. Hence we find the change commencing intertropically, and, following the current of atmospheric circulation, gradually spreading in an anti-zonal direction. The first record is of heavy rain at Bayonne on the 10th; and again on the 11th, suddenly, with thunder and lightning, evidences of violent and rapid atmospheric decomposition. Of the 11th, subsequent news of shipping casualties tell us of heavy hurricanes in the Atlantic, about the latitude of 40 degrees, through several days. Gradually, this reaction extends to these latitudes. First, the decline of temperature, and the formation of heavy vapour masses, tell of the loss of atmospheric temperature by intertropical thunderstorms; whilst upper "cirri" denote the contraction of the air sphere, the condensation of its vapour in nuclei and strata, "whorled" by the different currents which cross its descent; 10th, and the condensation gives slight rain in England, a flood in the United States; 12-13th, and the precipitation becomes general. With Jupiter, rarefaction again sets in, but with

an atmosphere and soil generally cooled by electric decomposition and copious precipitation; hence the rapid disappearance of temperature in expansion, and the great difference observed even in Great Britain, with the low *minimum* which marked the culmination of the Jupiter period. Past this point, all impediment to total reaction was at an end. The lesser reaction of Jupiter was added to the greater one of Mars, and storm and downfall reigned supreme over the greater portion of Southern Europe, and more particularly in Spain, in which intelligence of November reports "continued and heavy rains in Valencia and Catalonia, overflowing the rivers, converting the prairies into immense lakes, and submerging the villages, destroying both the dwellings and many of their inhabitants. Fields, roads, railways, and telegraph lines, all have suffered in the general wreck." Of this, the "order or method of nature" has only inflicted on us the meridional offshoots, to occasionally intensify the more moderate reactionary influences which pertain to these islands.

I can only give this imperfect outline of the "laws and phenomena of weather in October," but I trust it may suffice to convey to the reader some knowledge of the great problem of the weather, the solution of which has been sought after so many years. I had endeavoured to point out the philosophy of the seasons by the absence or presence, alone or combined, of positions of Mars and Venus, as causes of drought and rainfall, intensified or retarded by the greater planet. I pointed out the possible absence of the first in September as one of the causes of its 95·57 inches rainfall at 350 places; and to confirm the deduction by denoting the presence and period of its influence in October, justified by its 36·78 inches in 180 places, despite the indicated reaction and its storm phenomena. The evidence of "law" and "order" is incontestible, and justifies its assertion as

the true philosophy and science of the weather, as will plainly appear, it shows the "weather," or atmospheric-condition, to be a constant succession of periods and changes —of years, seasons, months, and intervals—without order or regularity of duration or occurrence, according with the ever-varying positions whence their origin is derived; the phenomena of each again presenting an equal irregularity or diversity, as the result of the varying physical forces developed by it in the different localities and climates of the globe—that, in fact, the whole science is one of extremes and vicissitudes.

Yet, how has science sought the solution of this problem of weather, and its laws of progression? By the study of these extremes and changes? With a strange inconsistency, recourse has ever been had to the "Law of Averages." Taking the readings and totals of temperature, pressure, rainfall, etc., of years, months, weeks, and days, they have added them together, and taking their mean, have sought therefrom a general mean or average which would give a law of weather, and point out the condition of any similar period in future time. As a consequence, 50 years of indefatigable observation have failed to afford the least clue to the cause of the extremes of the barometric and thermometric curve, of rain, of storms, or of any other of the varied phenomena by which they are accompanied. The greatest success was that due to the indefatigable industry and ability of Lieutenant Maury, of the United States Observatory. Collecting the logs of numbers of vessels sailing over all the principle highways of the ocean, he gathered their weather details into groups, and taking therefrom a series of "five-day means," laid these down in charts in such a way as, pointing out the localities of least average disturbance, &c., enabled the mariner to abbreviate a voyage by many days, and avoid much disaster. But, valuable as this is, it was of

use only as an "average" or "general" law. Applied to "particulars," it failed at once. On being applied to for the best period for laying the Atlantic Cable, he choes the month of June, as a period when "no storm could occur in that part of the ocean." Occur it did, however, and with exceeding violence (it was a "Venus month"), and the cable was lost. Still, the general results of this system were so successful as to attract the attention of different Governments. The result was a Congress, and the establishment of several departments for the prosecution of further investigations, amongst them the Meteorological Department of the Board of Trade, superintended by the late Admiral Fitzroy, in which the "average" system was fully carried out, with the addition of its adaptation to "particulars," in the forecast of ensuing weather, and the issue of warnings of approaching storms. After years of trial, the question was referred back to the Royal Society, and a Government Committee appointed to inquire into the results. They find that the "mean" system had fallen into neglect; that the "particulars," or forecasts, failed to the extent of 25 and 64 per cent. as respects force and prevalence; and that, so far from "theory," there was no single principle to be found which could be applied to the knowledge of future weather by any "probable" successor.

Once more, therefore, the "average" philosophy has demonstrated its fallacy and uselessness when applied to any practical purpose, whether of investigation, explanation, or foreknowledge. Yet, what is the proposed remedy? With an incomprehensible inconsistency, condemning nearly the whole of the only really practical features, the Committee conclude their labours by recommending a return to the original fallacy—the inspection of logs and observations from all parts of the world, their reduction to "means" or averages, and finally to "elements," whence to deduce the "laws"

of weather. For this they propose, through the medium of the British Association at Kew, to occupy a further period of about 10 years, and disburse £100,000 from the public purse! For what end? That for which they condemn the present department—of not being able to leave behind one single principle whereby a successor might forecast the weather for "two days in advance." The "average" doctrine of meteorology has been tried for 50 years, and failed, at the hands of some of the ablest investigators the science has in its ranks. The object proposed, therefore, is worse than useless—it is positive mischief, obstructing the discovery of truth, the progress of science, and the well-being of humanity.

Am I in error in thus protesting against the perpetuation of this injurious fallacy? I have used only authentic returns. Let any one look at the facts of the rainfall table given above, and ask whether the department is not already possessed of materials which both could and ought to be converted to the better use and guidance of all affected by the laws of weather. For seven years they have been my principal materials, study, and guide. I will vouch for their philosophy and teachings, when freed from the fetters of theories which are opposed to every fact and principle of nature.

Your obedient Servant,

FREDERIC PRATT, F.B.M.S.

228 Hackney Road, Nov. 7, 1866.

No. IX.

THE WEATHER.

SIR,—Guided by experience of previous wet summers, most weather-wise folk gave expression to their fears of an

early and severe winter. As yet we have experienced even less than the usual number of brief "spells" of cold peculiar to the season—a fact for which we stand indebted to the friendly influences of the overruling Mars' position. In the ensuing month we have yet another to encounter, accompanied, however, by several phases of so peculiar a character as will, no doubt, make the whole worth special observation, as elucidating the laws of weather. I think, therefore, I may usefully enlarge on my former brief exposition of the future of 1866. December presents us the following scheme of positions, &c., influencing the line (A B) of the Earth's orbit:—

	N	x	(M)	(V) S	x	M	x	J (H)	
A									B
	2	5	7	11	15	19	23	27-8	

As the month will probably develop some extremes of a nature worth study, I will endeavour to give a more extended explanation of the features by which it is characterised. Looking at the above scheme, we find it marked by the occurrence of three solar positions (denoted by the parentheses), two of them of planets of violent and humid intensity, and the last for its extremes of temperature—two of them, again, further intensified by combinations with larger and powerful planets.

Entering the month, the earth first encounters the influence of Neptune, crossing its path on the 2nd. On the 7th, it meets the conjunction of Mercury with the sun, succeeded in four days by a similar position of Venus, further intensified by an angular position of Saturn. Leaving these, on the 15th, the earth enters the period of Mars, culminating on the 19th. Passing on, on the 23rd it enters the Herschel period, passing between that planet and the sun on the 28th, with the influence of Jupiter crossing the earth's orbit at the same time. Like November, we have the occurrence of the

balancing influences of Mars and Venus in the same month, with this difference, that, whilst in the former month an interval of two days only occurred between the two positions, both extending over a period of fourteen days, in the present month an interval of eight days only is found between them, the period of each being also reduced to nine days, and separated by the transition of the 15th.

Having thus explained the "construction," if I may so term it, of the month with respect to its influences, I will now endeavour to point out their probable action upon the weather, its vicissitudes and extremes.

Leaving Herschel on Nov. 29, the first position is that of the remote Neptune, here subordinate to the strong solar position of Mercury with the sun, the evaporative force of which will probably tend to prevent any extreme of rainfall, limiting the influence to some extremes of wind force the first few days. The position of Mercury is usually a very stormy one, with much downfall as the conjunction passes away. Here, however, it is closely followed by the double position of Saturn and Venus with the sun; hence I should look rather for an extreme of evaporation, productive of some marked decrease of temperature between the fifth and eighth days. The latter date, as a period of transition, may give rise to some reactionary influence of the humid nature of Venus and Saturn, culminating in heavy downfall and strong gales about the completion of the positions. Still, viewing it as a solar position, I should rather look for the sustaining of the evaporation and low temperature till the 10th or 11th, with dull, heavy skies and strong winds. Thence an immediate reaction, with heavy storms and downfall, and an increase of temperature till about the 16th, when the influence of Mars may acquire sufficient force to counteract the precipitation, and give milder and finer weather, with a temperature above average, to about the

23rd. This I deem as the most probable effect of this brief Mars' position, rather than any tendency, as an overlying influence, to overcome the reaction of the Saturn-Venus period, and sustain evaporation and temperature to the period of its culmination. Some possible storms and heavy rains with the change of the 23rd, which will give place to some considerable extreme of cold as the earth passes the triple influence of the sun, Herschel, and Jupiter. With such an extreme, we must look for immediate reaction, as the earth passes to the position of Venus again on Jan. 2, and between the sun and Mars on Jan. 8. Hence the improbability of any permanent depression beyond the Herschel position of Dec. 28, and the probability of 1866 closing with a rapid change of temperature, with heavy storms, and downfall of snow or rain.

I have no doubt that the extremes of temperature will be one of the principle features of the month, occurring at the periods stated. Still, let it be remembered, that heat and cold are not qualities imparted by the planets themselves, but rather generated by the decomposition of atmospheric condition resulting from the antagonistic forces of gravity and attraction of the earth and planets. Hence, with a heavy storm from Mercury, the transition to Venus and Saturn, by rarefying and expanding the atmosphere, may cause such an amount of heat to become latent as will make a very cold extreme with the 11th, followed by immediate reaction, as the result of the condensation produced by the greater force of gravity, setting free both heat and moisture, and generating violent storms and downfall, subsequently protracted by the influx of the intertropical storms. In such a way, the influence of Mars, as producing re-evaporation, is thus capable of giving rise to a very low temperature, more especially when culminating with a violent reaction to the south, as took place on Jan. 6, 1864, when,

with a position of Mars on the 3rd, the mean temperature fell uninterruptedly through the period from 45 to 23 degrees, marking the low minimum of 18 degrees as the earth passed the transition point of Jan. 5-6. At St. Louis (U.S.) the cold reached 24 deg. below zero. At Port Dalhousie (U.S.), "the lake, under the influence of the intense cold, presented a most fearful appearance. The great waves rolled sluggishly like molten iron, and clouds of white steam flew from them, assuming most fantastic shapes, while huge columns of what appeared to be black smoke rose at intervals in waving spiral forms to an immense height. The sun bursting occasionally with lurid glare through the masses of lowering clouds, lit up the awful picture, causing it to resemble one of Martin's grand and gloomy conceptions of the 'lake that burneth for ever and ever' more closely, I think, than any other earthly scene possibly could." During the same time—1st to 5th—such a storm raged in Trieste as had not been known since 1802, "people being violently dashed to the ground, and in attempting to rise many found one or other of their limbs had been fractured." Many similar experiences (really due to Mar's action) are given by Webster, of great extremes of heat and cold at the same dates in England, America, and Turkey, and which he made the basis for erecting a curious theory of the "transfer of heat and electricity" in the atmosphere.

Such facts as these upset all ideas of a "mean" philosophy, and admonish us how careful we need be in setting up theories respecting the special heat of the sun, moon, and planets—that, in fact, we can only apprehend the special vicissitude or change at any place from observance of the progressive phases of the time being, and studying the developing influences, without being able to predict absolutely the existence of any specific condition or extreme. Some such singular extremes and discrepancies may be observable

in the ensuing month; hence this notice of their nature may lend interest to their observation.

For rainfall, I should commend observation of the period 7th to 16th, as coinciding with the Saturn reaction of November. This, I think, will be the heaviest and most continuous period of the month. For storm phenomena, the 7th to 12th appear the most probable positions for extreme intensity and duration, with a recurring protraction over some portion of the pre-Mars period to the 19th. The 23rd and 28th are also periods worth attention and care.

In their report on the Meteorological Department, to which I adverted in my last letter, the Committee stated they were unable to discover the existence of any definite principle on which the issue of "storm warnings" was based. During the present month I have observed a singular "coincidence" (I think they so term this fact) between their issue and the several periods of planetary positions given in the linear diagram. Their continuous issue also singularly coincides with the Saturn period, previously noted as one of possibly extreme reaction. I have noted such things for years, as well as drawn the previous attention of the late Admiral Fitzroy to some of the most remarkable, as an illustration of the injustice he had inflicted on this philosophy, and how much more might be gained to science and humanity could such unfounded prejudices be set aside. Let me, therefore, draw attention to their issue in the ensuing month, and how far such "coincidences" may continue to develop themselves, particularly with the period between 5th-15th for a series, and the 7th or 8th, 11th, 15th, 20th, 23rd, and 27th-8th days, as the most likely dates for their disconnected issue. For this purpose, I have explained the "constructive philosophy" of the influences which govern the months, and pointed out their nature and probable contingencies. Apart from any opinion of mine as

to the special phenomena which such periods may develop, I cannot but think that observation alone of the several "points" would impart a better knowledge of the laws of weather than could be gained by centuries of "average" tabulation." Your most obedient Servant,

FREDERIC PRATT, M.B.M.S.

228 Hackney Road, Nov. 27, 1866.

No. X.

THE LAWS AND PHENOMENA OF WEATHER IN NOVEMBER.

SIR,—The influence of our Mars' exemplar during the past month is again so demonstrative of the fact of law and order in the phenomena of weather, that I venture to lay the results once more before your readers. I again use the returns of the Meteorological Department, first in the following table, showing the

COMPARATIVE PREVALENCE AND AMOUNT OF RAINFALL IN TWENTY PRINCIPLE PORTS OF THE UNITED KINGDOM DURING NOVEMBER, 1866.

Date.	Places.	Inches.	Date.	Places.	Inches.
1 Herschel	12	1·07	17 }		
2	13	2·50	18 }	17	3·83
3 } Neptune. }	14	1·39	19	4	·35
4 }			20 Ven-Jupiter	7	1·03
5	10	1·18	21	3	·10
6	7	1·49	22 MARS ...	11	1·19
7 Saturn ...	12	1·42	23	16	1·81
8	18	3·78	24 }		
9	4	·89	25 }	18	3.93
10 }			26 Transition	9	·36
11 }	19	11·32	27	4	·08
12	5	5·12	28	1	·22
13 Transition	16	2·77	29 Herschel	3	·91
14	7	1·00	30	3	·94
15	17	7·17			
16	15	3·55	Total ...	95	14·75
Total ...	169	44·65	Total of Month	264	59·40

In October the Mars position occupied the first column of the table; here, we find it in the latter. Its influence on the period is shown by the contrast of 95 places 14.75 inches in the 14 days, as opposed to 169 places 44.65 inches of the previous 16 days. This illustration of its influence over the rainfall of a period is the more striking from the fact of its being in addition to neutralising the rain-producing influence of Venus, as well as the reaction of Jupiter, the latter so prominent in the same period of October. Of the 44.65 inches of the first half, above one-half, or 23.61 inches, fell in the four days 10-12th and 15th, from the transmitted storms of the Saturn period. Comparing the reaction of Saturn with that of Mars, we have further proof of both influence and law, eight days of the former giving 32 inches rainfall to 8.25 inches of the latter, the whole reaction of which to close is just one-third of the 23.61 inches of the four days' extreme of the Saturn period. Compared with November, 1865, we have a total of 264 places 59.40 inches against 282 places 85 inches—a deficiency of 18 places 25.60 inches for 1866; November, 1865, again elucidating the same law with respect to Mars, in solar conjunction on the 11th, followed by Jupiter and Herschel on 24-5th, and Saturn on 29th. The ten days 3rd to 13th gave 39 places 6.88 inches; the ten days of 18-28th, 146 places 53.46 inches, or in the ratio of nearly eight to one. The following shows the comparative totals of the periods in the tables of the past and present months, denoting the Mars period by the asterisk (*):—

	FIRST PERIOD.		SECOND PERIOD.		TOTALS.	
	Places.	Inches.	Places.	Inches.	Places.	Inches.
October, ...	46	... 5·43*	134	... 31·35	180	... 36·78
November, ...	169	... 44·65	95	... 14·75*	264	... 59·40
Totals ...	215	... 50·08	229	... 46·10	—	—
Difference,	123	... 39·22	89	... 16·60	84	... 22·62

I give this table in order to show the difference between the philosophy of planetary periods and that of "means," if but for investigation only; and also to afford a practical proof of the fallacy induced by the average system. Mere inspection of each period suffices to show the influences of Mars, and the great deficiency of rainfall consequent upon the mutual position of that as compared with other planets; the influence of Venus appearing to a marked extent in the comparative monthly totals of 59 to 36 inches. Looking at the differences, we get such figures as reveal at once the existence of law, and the relation of cause and effect, whether by period or by month. But by taking the totals the characteristics of each period are annihilated by their similarity, and all clue is obliterated, any mean being equally valueless.

The next feature is that relating to storms, their prevalence, and the warnings issued by the Meteorological Department, the latter stated by the Royal Society to be "at present founded on rules mainly empirical." The following table shows the

MEAN DAILY FORCE OF WIND AND PREVALENCE OF GALES AT TWENTY PRINCIPAL PORTS IN NOVEMBER, 1866.

Date.		Places.	Force.	Date.		Places.	Force.
1	Herschel, ...	—	... 3.65	17			
2	... ...	—	... 2.90	18	... ...	8	... 5·95
3	Neptune,			19	... ...	4	... 4·75
4	...	—	... 3.70	20	Ven. and Jup.	—	... 3·40
5*	... ...	5	... 5.35	21	... ...	—	... 2·45
6	... ...	2	... 5.15	22	Mars, ...	—	... 2·60
7	Saturn, ...	6	... 5.95	23*	... ...	3	... 4·65
8*	... ...	14	... 6.95	24			
9	... ...	1	... 3.20	25	... ...	7	... 5·75
10*				26	Transition, ...	6	... 5·30
11	... ...	16	... 8.05	27	... ...	—	... 4·05
12	... ...	8	... 5.50	28	... ...	1	... 2·50
13	Transition, ...	16	... 7.15	29*	Herschel, ...	4	... 4·70
14	... ...	6	... 5.15	30*	... ...	6	... 2·50
15*	... ...	8	... 3.70			—	... —
16*	... ...	12	... 7.40		Total, ...	39	... 48·60
	Total, ...	94	... 73.80		Total of month,	133	...121·40

In this table I have given, from the daily reports, the mean force of the wind at 20 places, the number of places at which it reached the gale force of 7, and denoted by asterisks the days on which storm warnings were issued. Comparison of the two tables will show the rule of law and order by the coincidence of their results, the comparative difference of the periods, and their relation to the greater total. Of the total of 133 places at which gales prevailed, no less than 106 were due to the vicissitudes created by Saturn, Venus, and Jupiter, leaving but 27 to the remaining 11 days of the Mars period, giving a ratio to the former of 3 to 1. The influence upon the issue of storm warning is shown by their commencement on the 5th, in transition to Saturn, and their repetition on the 8th, 10th, 15th, and 16th days, thus covering 12 of the 16 days to Jupiter position. We then find it contemporaneous with Mars, and again with Herschel at the close. The highest mean force and the stormiest days were the 8th, 10-11th, and 16th days of the month, giving 58 of the 133 gale prevalences, and 29.55 of the 121.40 total force of the month. The influence of Saturn is thus shown to be something more than the myth for the ridicule of "really scientific men." Further proof of law is shown by treating the details in the same manner as the rainfall, in the following comparative table of the totals of the daily wind force, and the prevalence of gales in the two periods of October and November influenced by the Mars position(*), and those of its reaction:—

	FIRST PERIOD.		SECOND PERIOD.		TOTAL.	
	Places.	Force.	Places.	Force.	Places.	Force.
October (1 to 16)...	3 ...	35.80*	44 ...	57.50	47 ...	93.30
November (1 to 16)	94 ...	72.80	39 ...	48.60*	133 ...	121.40
Totals, ...	... 97	...108.60	83 ...	106.10	— ...	—
Difference,	... 91	... 37.00	5 ...	8.90	96 ...	28.10

The comparison of the first period is significant enough; the second is less so, as really containing 12 places and 10.70 force of the storm influences of Jupiter-Venus position. The more correct totals would be 56 places 68.20 force to 27 places 37.90 force due to Mars' action—in proportion, one-half nearly. In comparison with the results of this "periodic" analysis, the "total" treatment beneath annihilates all distinctions, bringing the results nearly equal. By "totals" the mean of the month would be 107.35; by "differences" 23 less!

It is, of course, a somewhat difficult task to manage the intricate details of the daily tables of the "Department," but I think the reader will have no difficulty in comprehending how much valuable philosophy lies at their base, could they be treated on any other than the "really scientific principles" to which they have hitherto been subjected. It may be said that these are merely picked instances. But, taking the last three years, I find that the Novembers have all been remarkable for these positions, the details of which, tabulated in periods from the same sources, furnish the following singular results in the table of rainfall:—

	FIRST PERIOD.		SECOND PERIOD.		TOTAL.	
	Places.	Inches.	Places.	Inches.	Places.	Inches.
1864 (1 to 16) ...	82	23·42	169	57·43	251	80·85
1865 (1 to 16) ...	86	20·16	196	64·84	282	85·00
1866 (17 to 30)...	95	14·75	169	44·65	264	59·40
Total,... ...	263	58.33	543	166·92	794	225·25
Mean,... ...	88	19.44	178	55·64	265	73·41
Daily mean, ...	5·3	1·21	13	3·97	8·8	2·44

Than these, I think, no figures could be more demonstrative of the existence of "law," or the absence of "empiricism." There is an unmistakeable significance in the totals of the respective periods, which no argument can set aside. As data, besides, they possess a real practical value,

as pointing out to the agriculturist the times and periods best adapted for his operations, and the most conducive to their successful results. Their value for scientific purposes is equally conclusive, as showing the advantage of "periodic" over "mean" data for the purposes of investigation; for, treated in this way, the pointless monthly "totals," and the monthly and daily "means," at once resolve themselves into data of such difference and contrast as, while revealing at a glance the "order or method of nature," furnish, besides, data and principles of incalculable use to science and trade.

Nor are the details of wind force and storms less conclusive when thus treated, as the following table shows:—

	FIRST PERIOD.			SECOND PERIOD.			TOTAL.		
	Places.	Force.	W.	Places.	Force.	W.	Places.	Force.	W.
1864	22	50·65	5	113	72·45	12	135	120·21	17
1865	26	48·65	6	114	73·55	11	140	125·85	17
1866	39	48·60	5	94	72·80	10	133	121·40	15
Total	87	147·90	16	321	228·80	33	419	370·46	49
Mean	29	49·30	5	107	76·27	11	140	323·49	16
Daily mean	2	3·08		5	5·45		5	4·12	

By the figures herein given, we find that, in the first (or Mars) period of 16 days of 1864, of 320 observations the gale force of 7 and over was found to prevail in 22, the mean force of each day's 20 observations giving a period total of 50·65 inches, with storm warnings (W.) covering 5 days of the 14 days' period. In the second (or reactionary) period the gale forces become 113, and the period total 74·25, with "warnings" covering 12 of the 14 days; the whole forming a total for the month of 135 (of 520) places gale force, 123·21 total daily mean, with warnings on 17 (of 30) days. And, taking the three years in this manner, it is a singular testimony to the accuracy and value of the "periodic" philosophy to observe how nearly the separate results of each period, as well as the final totals, coincide

with each other. Now, applying these results to practical use, the navigator, coaster, or fisherman would find (by the daily mean of column 3) that of 20 places, covering the entire coast of the United Kingdom, he would incur the probability of gales daily to 25 per cent., with a mean force of 4·12 or about half the gale force; and with the coast, in different portions, under warning for 16 days. Thus, by the "scientific" system, whether by "total" or "average," he would have no means of selecting any favourable period whatever, hazarding all to mere chance. Taking the "period" columns, however, he would find that during the first or Mars period he might put to sea, or approach land, with the probability only of meeting the gale force in two places of an entire coast of many hundred miles; whereas, in the second period, he would receive both a protection and warning, from the increase of gale prevalence to the extent of 35 per cent., and the doubling of the daily force. Nor is the mean philosophy at all enhanced by "five-day means," as proposed; for, extending over a series of years, it is evident that they would include both periods of extremes, which would neutralise or balance each other, and thus leave the navigator in the same "glorious uncertainty" of "science." Now, if, in place of this "really scientific" mode of fishing for "elements," the periodic principles were carried out over the great "homes and highways" of the globe, it is manifest that navigation would at once acquire the full amount of "average" protection in every quarter of the world; while, with the chart of positions, and a slight experience of their nature and influence, the mariner would be put in possession of so much of the science of "particulars" as would enable him to foresee and prepare for any possible emergency or crisis of period or position, and avert an incaculable amount of ruin and disaster both to life and property.

With these facts and figures, so demonstrative of the hidden philosophy of these materials, is it not a libel on science and philosophy to cast upon them the stigma of empiricism? Would it not appear that both judges and the judged were alike wanting in the science necessary to their comprehension or elucidation—that, in fact, no "really scientific" principles have ever been brought to bear upon either their discussion or judgment? So far from being "empirical," I think that the facts and figures I have educed abundantly demonstrate that the materials thus unjustly stigmatised contain within them all the elements of a new and valuable philosophy, of the highest use and adaptation to all the wants and purposes of human welfare as connected with "the weather."

If a knowledge of the laws of storms, or warning of their occurrence or approach, be of any worth to our maritime interest, the work is worth doing well and thoroughly, free from the trammels of creed, science, or authority. It should be carried out by the co-operation of shipowners, etc., with practical men—who, acquainted with the needs and wants of the case, would, by their freedom and impartiality, be enabled to select from any system the principles best adapted to ensure the end required, and to procure those principles a fair and careful test by practice and experience, and thus form a code of cautions and instructions which, coming from among themselves, would meet with that respect and hearty co-operation which no previous efforts have been able to attain. The work is a great one, but, as at present carried out, it is one-sided and useless, obstructed by distrust and rewarded with indifference. With a cry for foreknowledge of weather almost universal, every attempt to reduce it to a science by the true test of predictive experiment is treated with derision or contempt; hence the proverb of M. Arago, "That no man with any reputation would attempt the pre-

diction (or 'foreknowledge') of weather." Other sciences are equally tentative—as chemistry; yet who would think of rewarding its professors with contempt or abuse for an unsuccessful experiment? If we want a "weather" science, let the effort to obtain it but meet with the respect and attention obtained by other branches of human knowledge, and which it justly deserves. Science, I am convinced, would not long be wanting, nor able professors to elucidate it.

Your obedient Servant,

FREDERIC PRATT, M.B.M.S.

228 Hackney Road, London, Dec. 12, 1866.

ATMOSPHERIC PHENOMENA FOR 1865

COINCIDENT WITH PLANETARY POSITIONS.

NOTE.—The sign (x) denotes the transition period, when the Earth passes from the influence of one planet to another.

Planetary Positions.	JANUARY.
5th ♃ 30° ☉	2. Three slight shocks of earthquake at Beeston, Nottingham—wave N. to S.
8th ☿ ☌ ☉	
12th (x)	3-8. Violent gales and hurricane, with heavy snowstorm, rain and hail, with lightning in various parts of British Isles, from W.
16th ☿ 30° ☉	
20th ♄ 90° ☉	
23rd ♂ 120° ☉	
25th ♆ 60° ☉	12-14. Very stormy, with rain, hail, and snow, from SW., British Isles.
	14. London—barometer 28·60, lowest in five years' observations. At Greenwich, barometer 28·39, lower than any since February, 1848, then 28·30.
	16. Strong gale with snow and rain; broad band of atmospheric light and aurora.
	18. Hurricane at Constantinople from S.
	21. London — singular black fog; total darkness.
	22. Variable temperature—Dumfries, 23° in morn., and 40° to 43° at noon in shade.
	23. Strong gale at Forney, from ESE.
	26. Strong gale with snow; Armenian steamer wrecked off Arklow Head.

Planetary Positions.	
	27-30. Gales, with snow, from NE. to SE., with unusually high tides, and lat. 48° to 50° N., long. 17° W., hurricane. 29. Extreme cold. Ballater, mercury disappeared in ther.; Strathdon, 7° below zero, not so low for thirty-two years previous, except in January, 1861. Russia—ther. 26° below zero, not so low for sixty years. Peeblesshire on 13th, bar. 28·00. The snow-storm in some parts of Scotland not been equalled in the memory of anyone living.
	FEBRUARY.
2nd & 3d (x) 12th ☿ 60″ ☉ 14th ♅ 120° ☉ 19th ♄ 120° ☉ 22nd (x) 25th ♆ 30″ ☉	1-8. Lat. 45° N., long. 22° W. (1st)—hurricane from NW. British Isles (2-4)—severe gales, with rain, sleet, and snow, from SE. American steamer experienced (3-8) heavy gales from NW. to SW. 4 and 5. Kurachee, East Indies, severe storm. 7. Virginia, U.S.—heavy storm, rain freezing as it fell. 9-20. Very keen frost, with heavy fall of snow. 11. Severe gale, with hail, rain, and snow, from SE., British Isles. 14. Severe gale from SW., British Isles. 15. Severe shock of an earthquake at Furness, North Lancashire; ice heaved up and cracked. 15, 17, and 21. Atmospheric light of great brilliancy.

Planetary Positions.	
	18-20. Violent gales in British Isles from W. and NE.
	23 and 28. Gales with rain, from W. and N.W.
	Great fluctuation in bar. at Wigtownshire —on 19th 28·532, and on 20th 29·922; wind WSW. on 18th, and NNE. on 19th. Brilliant comet seen at Melbourne and Cape of Good Hope from 23rd Jan. to 4th Feb.
	27. Australia—dreadful heat, 105° in shade; appalling bush fires. St. Petersburg —62° of frost during first fortnight of the month.
	MARCH.
4th (x)	2. Gale, with heavy sea, from NW., British Isles.
10th ♂ 90° ☉	
13th (x)	4 and 5. Strong gales, with hail, rain, and snow, and violent thunderstorm.
16th ♅ 90° ☉	
18th ♃ 90° ☉	5. Aberdeen—lunar halo and aurora.
19th ☿ ☌ ☉	8-10. Gales, with rain and hail, from N., British Isles. New Zealand—general gales from S. and SW.
" ♄ 150° ☉	
23rd & 24th (x)	15-22. Lyttleton, N.Z.—severe gales.
28th ♆ ☌ ☉	16-20. Violent gales, with hail, snow, and rain, from ESE., British Isles.
	18. Pennsylvania—great flood.
	20. Broad band of atmospheric light, stretching from E. to W., seen in various parts of Scotland; the last seen at Isle of Whithorn was on 26th March, 1826, previous to the driest summer on record. Cumber-

Planetary Positions.	
	land—extraordinary meteoric arch, followed by a brilliant display of aurora borealis. 21. Bucharest—terrible inundations during last five days, one-third of the place being under water more than 3 feet deep; roads and bridges destroyed. 22. Paris—most severe weather for last three days; to-day, hard snow, several inches deep in the country. 22 and 23. Marseilles—violent gales from NW. 22-26. Lat. 12° to 18° S., long. 82° to 85° 30′ E.—hurricane with torrents of rain, ENE. and SSW. 26. Violent gales, with rain and sleet, with vivid lightning, British Isles. 28. Cape Horn—severe gales. Switzerland and Tyrol—snow 10 to 15 feet deep. In Vienna the cold for two days in succession was 12° below zero, a phenomenon that has not been observed since 1775. The range of temperature for the month was great—Glasgow, 24° to 58° in shade; London, 25° to 65° in shade.
	APRIL.
7th (x) 16th ☿ 30° ☉ " ☿ 60° ☉ 17th ♄ ☌ ☉ 19th ♃ 120° ☉	A month of extremes in temperature—Glasgow, 31° to 69° in shade; London, 33° to 79° in shade; at Greenwich, on 27th, maximum in shade, 79°; at Cromar (Aberdeenshire), minimum in shade, 18° on 30th. Diurnal range also great; at Glasgow on

Planetary Positions.	
23rd & 24th (x) 28th ♆ 30° ☉	25th, temperature ranged from 36° to 69°; on 30th, minimum temperature 34°, maximum in sun 84°; in Glencoe the thermometer in sun on several occasions reached 102°, with cold nights. Aberdeen, 16th to 22nd, the temperature ranged from 29° 8′ to 75°. According to observations made at the Royal Observatory, Greenwich, the mean temperature of the month was nearly 3° higher than the average for April during twenty-three years' observations, and almost equal to the average of the twelve months' observations. 5. Montreal—great flood, within a few inches of that of 15th April, 1861. 7. Braes of Glenlivet—snow lying 8 to 10 feet on some farms, and on hills 20 feet. 11. Simla, W. India—shock of an earthquake. 12 and 13. Severe storms of hail, rain, and thunder. 14. Shields—1·50 inch of rain. 16. Bright auroral arch, double. 17-19. Violent thunderstorms, with heavy rains in various parts of the country. 18. Scandinavia and Russia—a hurricane, which extended to the Black Sea. 23. St Pierre, West Indies—dreadful flood. 24. Pentland Hills—a bright solar halo seen very distinctly from seven A.M. until noon. Gales on 1st, 2nd, and 4th to 6th from SW., 10th from NW., and 26th to 29th from NW. and SE. 30. Brilliant Meteor seen at Bucks.

Planetary Positions.	MAY.
1st (x)	A month of great extremes in temperature, and great electricity. Glasgow—temperature, 34° to 76° in shade.
3rd ☿ ☌ ☉	Gales on 4th, 10th, 27th, and 30th.
5th (x)	7. Cambrai, France—Canal blocked up by 40,000 cubic yards of ice (hail), 600 men employed to break it up.
8th ♀ ☌ ☉	8. Destructive hailstorms in France.
11th & 12th (x)	9. Scotland—shock of an earthquake.
15th ♄ 150° ☉	9-12. Terrific thunderstorms, with torrents of rain and hail, in various parts of the country.
" ♂ 60° ☉	10. Peeblesshire—a heavy fall of snow.
18th ♃ 150° ☉	12. Wigtonshire—some sleet and snow. St. Thomas, West Indies—two shocks of an earthquake.
" ♅ 30° ☉	12-14. South Australia—heavy gales.
24th (x)	15-18. Cape of Good Hope—terrific hurricane.
30th ♆ 60° ☉	17. Scorpion arrived at Limerick (5th May) from Bardadoes, had a succession of heavy gales throughout.
31st ♀ 30° ☉	20. Centurion encountered a fearful hurricane at the antipodes.
	21, 22. Chatham Islands, New Zealand—worst gale known for years.
	22-24. Terrific thunderstorms, with torrents of rain and hail, in various parts of the country.
	23. Germany—severe thunderstorm, with heavy rain.
	Lyttleton, New Zealand—24th to 27th, very stormy, many wrecks.

Planetary Positions.	
	Lat. 44° S., Long. 106° E.—24th, a hurricane lasting twenty-four hours.
	26. Cape Finisterre—hurricane for nineteen hours.
	28. Wigtownshire—a great deal of thunder.
	30. Terrific storm in the Baltic, fifty vessels wrecked.
	JUNE.
7th (x)	The heat during this month was of unusual
14th ♄ 120° ☉	intensity, and not restricted to this country,
15th ♃ ☌ ☉	but experienced throughout the continents of
18th (x)	Europe, India, and America. On 18th, at
21st ♅ ☌ ☉	seven A.M., Argyleshire, thermometer in shade
25th & 26th (x)	71°, and in sun, 110° 5′; at Greenock, thermometer in sun 148°; on 21st, Invernessshire, thermometer in sun 132°; on 20th, Roxburghshire, thermometer at noon in shade 87°; Forfarshire, the thermometer in shade on several days reached 85°; 21st, St. John's College, Hurstpierpoint, thermometer in shade 88°. Montreal, 17th, 98° in shade; 18th, 96°; 19th, 88° 7′. New York, 17th, 91° 5′ in shade; 18th, 92°. Umballa, India, 24th, thermometer in shade 120°. (The highest temperature in shade ever known in this country was 96° at Birmingham on 7th June, 1846.
	9. Cape of Good Hope and New Zealand—heavy gales.
	10. Wigtonshire—strong gale from NNW. Morayshire—hurricane from SW.

Planetary Positions.	
	11. Madagascar and New Zealand—heavy gale.
	12. Lat. 47° N., long. 39° W.—severe gale from N.
	20. Coreze, France—frightful hurricane.
	24. Lat. 38° S., long. 136° E.—heavy gale.
	24 and 25. Coast of Brazil—heavy gale.
	26-30. Cape of Good Hope—heavy gales from E. and SE.
	30. China Seas and New Zealand—violent gales.
	JULY.
1st ☿ ☌ ☉	Another very warm month, great electricity, with some frost at night in various parts of the kingdom. On 1st, in Peeblesshire, thermometer in sun reached 134°; 2d and 5th, Orkney, 107° in sun; 23d, Castle Howard, Yorkshire, 85° in shade, and on 24th 87° in shade. 18th, Heringsdorf—intolerable heat for four days, ther. 86° in shade, temp. of water (sea) 65° to 70°. Belgium, Hamburg, and Berlin, 24th to 29th—great heat. British Isles—gales on 4th, 5th, 8th, 13th, 15th, 27th, to 29th, from NW. to SSW.
" ♆ 90° ☉	
6th & 7th (x)	
14th ♃ 150° ☉	
16th ♄ 90° ☉	
20th (x)	
24th ♅ 30° ☉	
28th & 29th (x)	
	7. Rothes—rained for twenty hours in succession. Pomerania, Prussia—severe thunderstorm, with heavy hail showers.
	10. Kirkcaldy—severe thunderstorm, with vivid lightning. Kirriemuir—torrents of rain, with heavy hail shower.
	11. England—violent thunderstorms, with heavy hail showers. Trieste—severe gale.

Planetary Positions.	
	12. St. Petersburg—a hurricane. 13. Wigtownshire and Aberdeen—thunderstorms. Banff—thunderstorm, with heavy rain. Telegraph wires on portion of Banffshire railway destroyed by lightning. 13 and 14. Styria—several shocks of earthquake. 15th and 16th, Catania—do. 15. Braemar—perfect hurricane, with heavy rain lasting fourteen hours. 16. In lat. 36° 18′ N., long. 2° 32′ W., a vessel experienced a shock as of an earthquake, was shaken with great violence, the vibration lasting five minutes. Trinidad and Grenada—slight shock of an earthquake. 17. Cambrai and Maretz, France—hurricane, with hailstones and waterspout. 19. Jamaica—2 inches of rain in one hour and twenty minutes. 20. Kelso, Perth, and Stirling—severe thunderstorm, with drenching rain. 23. Cape Howse, N. S. Wales—terrific storm. 31. Kingussie—fall of snow, which lay on the Grampians for twenty-four hours. Lochwinnoch—very heavy hail shower.
	AUGUST.
2nd ♆ 120° ☉ 5th (x) 8th ♂ 30° ☉ 11th ♃ 120° ☉ 14th & 15th (x)	A warm month, great electricity, and much rain. In London the ther. in sun during nineteen days ranged between 100° and 115°, and maximum in shade on twenty days between 70° and 78°.

Planetary Positions.	
18th ♄ 60° ☉	1. Monifieth—a deluge of rain and hail, with thunder and lightning. Hamburg and Elsinore—a gale.
22nd (x)	2. Perthshire and Wigtownshire—thunderstorm, with large hailstones. Sandham—a gale. Assington, in Suffolk—terrific thunderstorm with hail.
26th ♅ 60° ☉	3. London; thunderstorm, with hail showers. Lynn; a hurricane.
30th (x)	5. Valparaiso; violent gale.
	5-7. Dantzic; gales.
	5 and 6. Hyderabad, India; tremendous rain storm, 13½ inches, 5 inches of which fell in three hours; 836 houses washed down.
	6. Bristol; 2·68 inches rain fell.
	6 and 7. La Plata; violent tempest.
	10. London; severe thunderstorm, with heavy rain.
	11. Dumfries; gale and thunderstorm. Barcelona and Tarragona; hurricane. Yokohama; hurricane, with torrents of rain.
	12. Wick; severe thunderstorm, with very high tide.
	14. Perthshire and Stirlingshire; thunderstorm, with torrents of rain. Trinidad; heaviest fall of rain for fourteen years; 4·08 inches in one hour.
	15. Shetland; heavy gale.
	16. United States; rain in torrents over the greater portion of the entire west.
	17. Mississippi and St. Thomas; slight earthquake. Fishguard; strong gale, SW.
	17 and 18. Wigtownshire; gale.

Planetary Positions.

18-24. Strong gales in south lat., and east and west long. 18th to 21st, Cape of Good Hope; strong gales.

19. Catania; two severe shocks of earthquake.

20. Lat. 20° 18′ N., long. 107° 30′ W.; a hurricane. Bay of Bengal; heavy gale from NW.

22. Sheffield and Greenside; violent thunderstorm.

23. Lat. 22° 42′ N., long. 123° 18′ E.; hurricane, with rain and lightning.

23 and 24. Bombay; gales; and heavy gales in SW. Russia.

25. Lat. 44° S., long. 34° W.; a hurricane. Bombay; incessant rains for thirteen days; 35 inches!

26. Off the Bahamas; heavy gale.

27. Cobourg; "So boiling, pitiless a sun I hardly ever remember on the north side of the Alps."—*Times'* Correspondent.

28. Paris; one of the hottest days of the year.

31. Fraserburgh; violent gale. Rome; temperature in shade 93°.

Temperature in shade at Rome on 26th, 97°; at Paris on 20th, 89°. Mean temperature at Glasgow, 59° 1′; at London, 61° 8′. 2d to 5th, Singular magnetic storms over Great Britain. 22d and 23d, Several meteors seen.

SEPTEMBER.

An unusually warm month, little rain, and

Planetary Positions.	
3rd ☿ 150° ☉	high barometer, similar weather being experienced on the Continent. The highest temperature in shade registered in this country this month was 87° 2′ at St. John's College, Hurstpierpoint. London, mean temp. 65°, maximum in shade 84° on 8th, and maximum in sun 122° on 15th. Kettering—maximum in shade 84° on 8th. Highfield House—maximum in shade 84° 6′ on 15th. Strathdon, for the week ending 15th the temperature was 12° above the mean of the last thirty-two years. Inverness—maximum in sun 120° on 15th. At Charente, in France, between 7th and 14th, the temperature in shade reached 96°.
5th (x)	Gales in British Isles, 1st and 3rd, 5th to 12th, 15th, 20th, 21st, 23rd, 27th, and 28th.
7th ☿ ☌ ☉	2-15. Baltic—very stormy. 4th, SW. Russia—strong gale. 3rd to 8th, China Seas—violent gales.
10th (x)	3. Lat. 52° N., long. 26° W.—gale. Cape of Good Hope—strong gales on 3d, 21st to 23d, and 28th to 30th.
13th ♃ 90° ☉	5. Spain—terrible storm of wind and rain. Tasmania, 7th, 11th, 12th, 23d, and 27th to 29th—heavy gales.
17th (x)	5-7. St. Thomas—hurricane off the coast.
21st ♄ 30° ☉	6. West India Islands—hurricane, with torrents of rain, thunder and lightning, and shock of earthquake.
24th (x)	6-7. Hurricane sixty miles west of the Gudaloupe.
27th ♅ 90° ☉	8. Lat. 48° N., long. 30° W.—violent gale.
30th (x)	

Planetary Positions.	
	9. London and Paris—violent thunderstorm, with heavy rain. 11. Peeblesshire and Kendal—shock of an earthquake. Lat. 41° N., long. 16° W.—shock of an earthquake. Gales in North Atlantic. 12. St. Margaret's Hope— a hurricane. 13. Revel, Russia—terrific gales. 14. Lat. 16° N., long. 112° E.—a hurricane. 15. Penkridge—brilliant meteor. 16. Demerara—shock of an earthqnake Riga—very stormy. 18. Boston—heavy gale. 19-22. Violent gales in North Atlantic. 20 and 21. Lat. 50° to 58° N., long. 20° to 21° W.—hurricane. 21. Lat. 28° N., long. 122° E.—hurricane. 21-28. Lat. 71° to 75° N., long. 9° to 8° E.—hurricane. 24th Lat. 72° N., long. 26° E.—heavy gale. 23. Australia and New Zealand—violent gales. 25. Lat. 50° 18′ N., long. 9° 40′ W.—heavy gale. 27. Perugia—shock of an earthquake. 27-29. Manilla—hurricane. 27th Lousiania—terrific storm at Grand Chemere. 28. Lat. 24° 30′ N., long. 69° 40′ W.—hurricane. Cape of Good hope—severe hailstorm, thunderstorm, and waterspout. One minute before the storm commenced thermometer was at 94°, and in seven minutes it sunk to 54°.

Planetary Positions.	
	28-30. Lat. 28° 30′ to 46′ N.. long. 23° to 66° W.—severe gales.
	OCTOBER.
2nd ♆ ☌ ☉	Gales in British Isles, 8th to 11th, 17th to 19th, 21st, 24th, and 25th, and hurricanes 27th to 31st. Thunderstorms on 9th, 15th, and 17th. Meteors and brilliant auroræ on 15th, 17th to 21st and 28th.
9th & 10th (x)	
17th ♃ 60° ☉	
19th (x)	
21st ☿ ☌ ☉	3 and 4. Lat. 18° N., long. 115° E.—hurricane. Lat. 71° N., long. 17° E.—gale. Cape of Good Hope—heavy gale.
23rd ♀ 30° ☉	
26th ♄ ☌ ☉	
27th ♅ 120° ☉	6-8. The Prefet de Marque, from Bombay, encountered fearful gales.
29th (x)	
31st ♆ 150° ☉	7. Lat. 36° N., long. 74° W.—heavy gale.
	8. Severe gales in Atlantic and off Cape Horn.
	8-12. Strong gales in North Sea.
	9. San Francisco—violent shock of earthquake, with very high tide.
	13. Cape of Good Hope—violent thunderstorm, with torrents of rain and strong gale on 14th.
	17-19. Panama and Colon—severe gales.
	18. Frederickshaven—strong gale.
	19-21. Bremen—heavy gales. 19th, Lat. 36° N., long. 72° W.—heavy gales. 20th, Lat. 27° 30′ N., long 79° 49′ W.—hurricane.
	20-24. Cape of Good Hope—gales. 21st, Lat. 30° N., long. 83° W.—hurricane. Havannah—severe storm.
	21. Lat. 29° N., long 70° W.—a hurricane.

Planetary Positions.	
	Cape Horn—heavy gales. Shanghae—severe gales in China Seas.
	22. Key West, U. S. hurricane—Lat. 44° S., long. 84° E.—heavy gale.
	23. Violent gale off Hatteras. Lat. 31° N., long. 79° W.—terrific gales. Lat. 29° N., long. 70° W.—hurricane. Comrie—shock of an earthquake.
	25. Lat. 32° N., long. 77° W.; heavy gale.
	26. Charante; westerly gales for last fourteen days. Lat. 48° 36′ N., long. 23° 30′ W. —violent gale. Lat. 30° N., long. 72° W.; hurricane. Lat. 34° 24′ N., long. 60° W.; terrific hurricane.
	27. Jamaica; shock of an earthquake; North of Scotland, Bar 28-70.
	29. Lat. 32° N., long. 67° W.; gale.
	31. 50° 50′ N., long. 10° 30′ W.; violent gale. Singapore.—several vessels put in through stress of weather. The Fury from Malaga to Boston, arrived 7th November, had westerly gales the whole passage. The Mersey, arrived at Quebec 7th November, encountered severe gale in lat. 49° N., long. 35° W.
	NOVEMBER.
5th (x)	Gales in British Isles, 5th to 13th, 15th to 19th, and 21st to 26th. Brilliant meteor on 21st.
11th ☌ ☌ ☉	
17th (x)	1. Lundy Island and Portrush; gale.
23rd ♃ 30° ☉	1-8. Cape of Good Hope; furious gales.
25th ♅ 150° ☉	4th to 5th, Cape Hatteras; severe gales.

Planetary Positions.	
27th (x) 29th ♄ 30° ☉ " ♆ 120° ☉	1-12. North Atlantic, from 39° N. long. 31°. W.—strong easterly gales. 4th, Banffshire—lunar rainbow. 2 and 3. Lat. 49° N., long. 25° W.—heavy gale. 5. Strathies—heavy shower of hailstones. Tucksima—heavy gale. 7. Lat. 17° N., long. 117° E—heavy gales. Lat. 35° N., long. 19° W.—severe gale. 10. Baltic—very stormy. New York—gale. Castlenovo and Ragusa—gales. 10-13. Fredericksbaven—strong gales. 10-14. Windau, Russia—gales. 11th, Gulf of Riga, bar. 28-80. 12-15. Pillau—fearful gales. 15th, Fryal—gale. 14. Lat. 18° N., long. 127° E.—terrific hurricane. 15. Lat. 43° 33′ N., long. 34° W.—strong gales. 16-18. Lat. 40° 48′ N., long. 54° 16′ W., succession of heavy gales. 16. Lat. 21° N., long. 126° E.—heavy gale. 18. Ship in lat. 24° S., long. 173° 33′ W., experienced shock as of an earthquake, compass card trembled violently; man at the wheel shaken violently; lasted from three to four minutes. Ship Orient, in lat. 51° 44′ S., long. 160° 40′ E., trembled violently from two to three minutes as from a submarine volcano. Ship Disraeli from Calcutta was off the Cape of Good Hope for sixteen days

Planetary Positions.

in very heavy weather, rounded the Cape on 29th. The Mercia, from Foo-chow-foo, encountered very heavy weather on 16th.

19-21. Lat. 46° to 48° N., long. 19° to 8° W.—terrific gales. 20th, lat. 39° N., long. 65° 20′ W.—heavy gale.

21-24. Quebec—very heavy gale. 24th, Lisbon—heavy gale.

21-30. Cape of Good Hope—gales off the coast. Vessels from Hong-Kong to San Francisco encountered severe gales on 19th, 20th, 21st, and 29th. The barometer was very low on 21st—at Waterford, 27.90; Leith, 28.00.

22-26. Off Lundy Island — hurricane. Steamers from Hamburg to Britain encountered terrific gales from 23d to 26th.

24-26. Bay of Bengal — violent storm. 26th, Paris—violent hurricane. 25th, off Wolf Rock—hurricane.

25. Lat. 46° N., long. 41° W., and lat. 54° N., long. 12° W.—severe gale. Pondicherry —several vessels seen dismasted from 26th to 29th. Comrie—shock of an earthquake.

25 and 26. Off Madras; hurricane. China Seas; violent gales.

26. Perthshire, Letham, and Braemar—hurricane, with fierce snowstorm and deluge of rain.

29. Lat. 28° N., long. 126° W., hurricane.

30. Lat. 41° 9′ N., long. 55° 4′ W.—gale.

At Hobart Town, Tasmania, the temperature in shade ranged during the month from

Planetary Positions.	
	39° to 95°. Adelaide Observatory, 20th—ther. in shade, 113° 5′.
	DECEMBER.
11th & 12th (x)	An unusually mild month, and great oscillation of the barometer. The extreme readings of the barometer for 1865 were in this month: viz., 30.87 at Cornwall on 15th, and 27.40 in NW. of Scotland on 31st, on which day the Lismore lighthouse was struck by lightning.
23rd ☿ ☌ ☉	
" ☿ ☍ ☉	
26th & 27th (x)	
30th ♃ ☍ ☉	
Jan. 1st ♄ 60° ☉	
	Cape of Good Hope: 1st to 13th, furious gales, and 23d to 30th, gales off the coast; on 13th, the barometer reached 27.00, not so low since the great storm of 18th May last; the thermometer in shade stood at 103°; cattle and sheep were struck dead from the heat, and fruit roasted on the trees.
	Gales in British Isles, 4th to 6th, 11th to 13th, 15th to 17th, 19th, 21st to 25th, and 28th to 31st.
	1. Lat. 41° 37′ N., long. 54° 25′ W.: heavy gale.
	4. Lat. 44° 9′ N., long. 44° 43′ W.: heavy gale, increased in force on 5th and 6th.
	7. Pontypool: brilliant meteor.
	12. Brazos, Santiago: violent gale.
	13. Constantinople: a gale.
	14-16. Konigsberg: gales.
	Lat. 39° N., long. 33° W.: strong gales on 14th, 15th, 20th, and 22d.
	15-31. North Atlantic: continued gales from long. 63° W. to that of Ireland.

Planetary Positions.

15. Calcutta, Akyab, Miduapore, &c.: terrific shock of an earthquake, repeated at intervals for some hours; wave from NW. to SE.; a clock vibrating E. and W. was stopped, while one working N. and S. continued steadily on. Steamship Herman left Southampton for New York on 20th, had heavy gales the whole way from SW. to NW., and snow on 31st. Ship Thurcaston lay to and drifted from lat. 45° 8′ N., long. 44° 20′ W., to lat. 42° N., long. 33° 40′ W., during a violent hurricane from 20th to 23d.

20 and 21. Lat. 44° N., long. 27° W.: very heavy gales. Lat. 43° 10′ N., long. 49° 15′ W.: heavy gale.

20-22. Lat. 37° 47′ N.: hurricane.

20-29. Lat. 46° 27′ N., long. 13° 13′ W.: heavy gales.

21. Tehara, Persia: heavy fall of snow, and severe cold; no such weather known for many years. The Brazileira, from Cronstadt to Boston, had fearful weather; lay to for seventeen days, and drifted from lat. 52° 30′ N., long. 30° W. to lat. 43° N., long. 19° W.; put into St Michael's on 6th January. Ship Neptune on 6th, in lat. 46° 9′ N., long. 24° 14′ W.: a gale; a heavy gale on 22d, and another furious gale on 24th and 25th, with severe cold. 23d and 24th, Lat. 37° N., long. 54° W.: a heavy gale. Buenos Ayres, 10th, violent storm; the hottest summer for a long period; temperature, 103° in-doors.

22-24. Lat. 45° N. long. 39° 30′ W.:

Planetary Positions.

heavy gales from NE. to NW.; on 25th gale shifted to WSW.

22. Lat. 44° N., long. 16° W.: heavy gale from SW.

Lerwick, 20th, 22d, 25th, 26th, and 28th to 31st: gales, with rain and hail, and very high tide.

24. Lat. 49° N., long. 24° W.: a hurricane. Lat. 56° 26′ N., long. 19° 24′ W.: severe hurricane, followed by strong gales for ten days, and heavy hailstorm on 29th.

25. North Atlantic: the gale on this date was one of the most violent ever experienced.

28. Lat. 51° N., long. 16° W.: severe gale.

30 and 31. South East of Scotland and Highlands: violent storm, with torrents of rain; at Skye, nearly two inches of rain fell on 30th.

Sandwick Manse, Wick, December: the driest since December 1853, and mildest since December 1857, the rain-fall being 1.517 inches less than the mean, and temperature 3° 41′ above it.

The places of extremes of rain-fall for 1865 were: Lochgoilhead (Argyleshire), 107.70 inches; Covesea, Skerries, 13.72 inches.

Island of Barra, 1st January, 1866, correspondent of *Inverness Courier* wrote: "Never have we had such boisterous and unsettled weather as experienced during last two months, and the island has not been so

Planetary Positions.

unhealthy for many years as it is at present."

ADDITIONAL DATA.

Ship John Bunyan from St John's, N.B., to Greenock, from lat. 43° N., long. 63° W.: had strong gales from 15th December to 15th January.

Tasmania, Dec.: gales on 1st, 17th to 19th, and 24th; great heat until 15th, after which heavy rains, especially on 21st.

8th Nov., lat. 34° N., long. 21° W.: a hurricane from NE. to SE.

Jan. 27: Two slight shocks of earthquake at Beeston.

June 27 and 28: A tornado passed over the NW. States of North America, destroying one village completely.

Nov. 13: Greenwich, from 1 to 5 A.M., magnificent display of meteors.

ATMOSPHERIC PHENOMENA FOR 1866.

COINCIDENT WITH PLANETARY POSITIONS.

JANUARY.

1st ☿ ☌ ☉
" ♄ 60° ☉
10th & 11th (x)
20th ♅ 150° ☉
23rd & 24th (x)
27th ♆ 60° ☉
29th & 30th (x)

A month of great reaction in temperature, and oscillation of the barometer, with considerable downfall. At Glasgow, the minimum temperature on the 8th was 38°; on 12th, 19°; and on 14th, 46°. The max. temperature (in shade) on 12th was 33°; on 14th, 54°; and on 16th, 43°. The barometer on 6th stood at 29·93; on the 9th, 28·63; on

Planetary Positions.

the 20th, 29·15; on the 24th, 30·48; on the 29th, 29·35; on the 30th, 29·98; and on the 31st, 29·10.

British Coasts—violent gales with heavy fall of snow, hail, and rain, from 1st to 4th, 6th to 15th, 18th, 22nd, and 27th to 29th. The number of vessels wrecked on British Coasts up to 15th amounted to between 300 and 400; on the 10th there were 40 vessels wrecked and 100 lines lost at Torbay. The seaboard of France, from the Loire to the Seine, was strewed with wrecks.

2nd., Mexico, violent shock of an earthquake. 3rd, Puebla and Orizaba, severe shock of an earthquake. 5th, Cape of Good Hope, shock of an earthquake, with great heat, and on the 8th, violent thunderstorm, with perfect flood of rain. 5th, Sat. 28° S. long., 63° E., a hurricane. 5th to 8th, Canada and New York, extreme cold was experienced, the ther. ranging, according to locality, from 10° to 34° below zero, accompanied by a very high barometer, at Kingston, rising above 31 inches; at Cincinnati the temp. fell 50° from 19th to 20th. 8th and 10th, Bremen and Elsinore, gales from SW. 8th, lat. 41° N., long. 62° W.; severe hurricane from NE. West India steamer, 9th, in lat. 47° 38′ N., long. 30° 13′ W.; gale from WNW.: bar. 30·15, wind force 6. 10th, lat. 48° 4′ N., long. 25° 10′ W., wind force 8, bar. 29·70. 11th, lat. 48° 15″ N., long. 22° 35″ W., wind force 6. N. bar. 30·17,

Planetary Positions.

hove-to all night of 10th; bar. 29·50 at 8 P.M., wind N., veered to NE. by E. and back to N. Brig "A. Milliken," from Cienfugos to New York, twenty miles north of Cape Antony, had heavy northerly gales from 4th to 10th, and on 28th was blown into the Gulf Stream. 9th, Gulf Stream, heavy gale from NE. 11th, London, gale, with heavy snow-storm, telegraph wires broken. Jersey and Fecamp, a hurricane from SE. to NNW. "London" (ss) foundered at sea in lat. 37° N., 220 lives lost. "Rhone" (ss), from Southampton, encountered terrific gale from SE. to ENE. 13th and 14th, lat. 19° to 36° S., long. 70° 1′ to 81° E., terrific hurricanes from N. to S. 1st to 16th, brig "Beaner" encountered strong gales from N. to NE. north of Cape Hatteras, and severe snow-storm on 15th. 5th to 20th, lat. 44° to 49° N., long. 11° to 12° W.; terrific gales. "Wickopee," from Liverpool to Charleston, sailed on 4th, was 21 days in Channel, with terrific gales from SW. to NW. 16th, "Royal Albert," from Calcutta, totally lost in Bute Bay, Cornwall, and all on board perished. 17th, Madagascar, a hurricane; "Surprise," from Yokohama, arrived at New York on 23rd, experienced heavy northerly gales south of the Gulf Stream, one of which lasted three days, and between Cape Hatteras and Delaware had NE. gales, with snow and ice. 20th, Ottawa, gale, and violent thunderstorm, with torrents of rain. Canada, 17th and 20th to

Planetary Positions.	
	22nd, gales from WSW., with thunderstorm on 20th, magnificent halo round the moon on 24th, and gale from E. with heavy snow-storm on 25th. 21st, "Wild Deer," from Shanghae to London, experienced terrific gale from NE. in lat. 35° 50′ N., long. 33° W., and was driven ninety miles west. 21st to 23rd, lat. 34° to 42° N., long. 28° to 34° W., heavy gales from ENE. 20th to 26th, ship "Knight," from Liverpool to New York, experienced terrific gales from NE. 21st to 26th, ship "Palmerston," from Calcutta to London, experienced strong gales, and was so much damaged as to be abandoned. 21st to 30th, Azores, strong gales from NNE. to SE. 24th, New York, vessels arrived from Europe, report heavy gales from NW. the entire passage. 23rd, Moulmein, shock of an earthquake, wave W. to E. Bar. 30·12, ther. 79°. 25th, Gibraltar, heavy gale from NE.
	FEBRUARY.
1st ♄ 90° ☉ 4th (x) 7th ♃ 30° ☉ 12th & 13th (x) 18th ☿ 120° ☉ 21st & 22nd (x) 25th ♀ ☌ ☉ 27th ♆ 30° ☉	The first eight days were mild, stormy, and wet; from the 12th to 21st a good deal of keen frost and snow, with some electrical phenomena—the month closing with cold storms and some frost. British Coasts, 1st to 7th, violent gales with heavy rain, hail, thunder, and lightning, from SW. to NW.; and 11th to 14th, and 22nd to 28th, strong gales from SW. to NE.,

Planetary Positions.

and heavy snow-storms on 14th and 15th, and 28th and 29th.

4th, Belfast and Plymouth, violent thunderstorm and hurricane, with rain and hail. 5th, Crief, shock of an earthquake. 4th, lat. 37° 9′ N., long. 68° 30′ W., heavy gale. 3rd, Natal, gales for some days. 4th and 7th, lat. 20° S., long. 61° to 67° E., very heavy gales from N. 2nd and 3rd, Lyttleton, NZ., heavy gales from SW. 8th, Cape of Good Hope, heavy gale from SE. 2nd to 18th, "Oracle," from Hong Kong to San Francisco, experienced terrific gales from E. and W., with irregular and dangerous seas about lat. 36° N., long. 150° E. to 160° W. 4th to 8th, Bremen, heavy gales from WNW.

7th, Stettin, very heavy gale from W. 6th, Kirkwall, a hurricane; bar. 28·55 at 10 A.M.; 29·15 at 10 P.M., and on 7th, 28·55. 2nd to 7th, steamer "Germania," from Hamburg to Hull, experienced very heavy gales from NW. 4th to 15th, ship "Result," between Corvo and Cape Clear, experienced strong gales from N. and S. 6th and 7th, Dunse and Glasgow, brilliant band of electric light spanning the heavens from E. to W. 9th, Burghead, snowstorm; and Dumfries, deluge of rain. 9th, Pillau, complete hurricane for the last 6 days from NW. 8th, lat. 55° 50′ N., long. 5° 25′ E., heavy gale from WSW. 1st to 12th, Bay of Biscay, heavy gales from SW. to NW. "Jason," from St. Jago de Cuba to Bremen, in lat. 45° N., long. 33° W., ex-

Planetary Positions.

perienced heavy gale from SW. to NW. on 8th, and continuous gales from NE. from 14th to 22nd. 9th, St. John's, N. F., for the last week heavy gales with snowstorms from NW. to NE. 12th and 13th, Madagascar and Mosambique Channel, a hurricane. 12th, St. Michael's, terrific gale from NE., lasting 45 hours; and gale from N. on 27th. 11th and 12th, Amsterdam, Dordt, and Hamburg, gale from NE. to NW., with high tide. 11th, Plymouth, the bar. went down to 27·90, and rose to 28·90 during the day, and a terrific gale, with hail and rain from SW. to NE. 14th, Wick, lunar rainbow. 15th and 16th, lat. 29° S., long. 40° E., a hurricane. 14th, lat. 22° 14′ S., long. 3° 41′ E., a hurricane. 14th, Kirkwall, beautiful auroral arch lasting fully an hour. 19th, La Chapelle-Sargean, France, two loud peals of thunder, followed by a ball of fire, which, descending to the earth, passed right through a house. 19th, lat. 39° 30′ S., long. 61° E. a hurricane. 20th, Sweden, the fall of snow lately has been so heavy as totally to suspend railway traffic. 21st, Hawick, magnificent display of aurora, illuminating the whole heavens, and the light so strong that the moment figures on a modern sized watch were distinctly discernible. 7th, 13th, and 25th, Aberdeen, auroral arches. 22nd, Wick, Thurso, Keith, Aberdeen, New Pitsligo, and Torpicken, a meteor of dazzling brilliancy, passing from E. to W., of conical shape, about the size of full

Planetary Positions.

moon, sent forth a ball of red fire to the west from its circular end, and through this ball, discharged itself into a shower of sparks. 23rd, Highlands, heavy snowstorm, and hurricane from NNW. 23rd to 26th, Baltic, very stormy weather. Halifax, 23rd, the "Worcester," from Liverpool, arrived, had heavy gales the entire passage. 22nd to 24th, "Yorick," from Liverpool to New York, experienced strong gales from W. to SW. 26th, Dunbar, severe snowstorm, with gale from N. Berwick, in midst of a snowstorm and gale, a vivid flash of lightning, and loud peal of thunder. 28th, east coast of Scotland, heavy snowstorm, 26th to 28th, "Peruvian," from New York, experienced heavy easterly gales, with snow and hail. 27th, "La Plata," from St. Thomas, in lat. 48° N., long. 13° W., experienced most violent gale from E. 28th, "Sebastopol," from Madras to Mauritius, experienced a hurricane. St. Thomas, very stormy for some days. Glasgow, 1st March, "Polly," arrived from Tynemouth, experienced terrific weather off Isle of Man. "Launceston," from Sourabaya, arrived at St. Helena on 12th, March, experienced a hurricane in lat. 25° S., long. 68° E., and another in lat. 26° S., long. 66° E.

March.

1st ♂ 30° ☉
2nd ☿ ☌ ☉

This month was characterised for its extremes of temperature and pressure, heavy

Planetary Positions.

2nd ♄ 120° ☉
9th & 10th (x)
17th ♃ 60° ☉
20th ☿ 90° ☉
25th (x)
30th ♆ ☌ ☉

snowstorms and keen frost, severe gales and electrical phenomena. In London, the range of temperature for the month was from 25° to 65°.

British Coasts, strong gales from NE. to SE. on 1st, 6th, 9th, 10th, 12th to 20th, and 23rd to 25th, and from SW. to W. on 29th and 30th. 1st, Braemar, gale, with fierce snowstorm. 1st, "John Clark," from Liverpool to Philadelphia, in lat. 33° 44′ N. long. 45° W., heavy gale, and from 24th to 29th, very heavy weather. 1st, Roxburghshire, min. temp. 12°. 13th, "Horsa," arrived off Deal, reports, for 21 days, from lat. 19° N., to the Channel had strong gales from N. to E. 4th, Strathdon, ther. 1° below zero, being 3° lower than on any March for the last 33 years. 5th, Aberdeen, min. temp. 15°; Kelso, min. temp. 12°; Kirkcudbright, min. temp. 17°. 5th to 7th, Highlands, constant and heavy snowstorm, followed by high winds and more snow from NE., depth 3 feet 4 inches—the drift in some places being 18 feet deep. 6th, Dumfries, heavy fall of snow. 1st to 4th, "Yorick," from Liverpool to New York, experienced a hurricane from NE. to SE. Bar. 28·90 on 1st, and strong gales from W. to NW. from 18th to 31st. 7th, Auchintoul House, Marnoch, shock of an earthquake; and Flugga Rock Lighthouse, near Shetland, shock of an earthquake, shaking the tower terribly, and causing the red shades to rattle for 30 seconds. 9th, Orkedal,

Planetary Positions.

near Drontheim, Norway, 2 A.M., shock of an earthquake, followed by a great storm of wind and snow from N. on 10th. Ther. 35° *below zero* on 1st; brilliant band of electric light on 7th, and ther. 25° on 8th. 8th, lat. 46° 36′ N., long. 7° 26′ W., gale from N. 8th, Braemar, snow is now above 3 feet deep, and still falling heavily, the heaviest fall since 1799 and 1838. 12th, Roads blocked up and rivers frozen. 4th, "Sebastopol," from Madras to Mauritius, experienced a hurricane. 4th, Cape Horn, terrific hurricane. 6th, coast of Mexico, heavy gale from N. 12th, Key West, gale from E. 22nd, "Tanjore," from Alexandria, arrived at Southampton, had heavy gales from SW. from Gibraltar to Cape St. Vincent, and thence to Cape Finisterre very unsettled, with NE. gale. 23rd, "Briton"(ss), from Cape, arrived at Plymouth, had strong gales from lat. of Madeira to Cape Finisterre, and in Bay of Biscay from NE. 27th, "Glencoe," from Shanghae, arrived at Gravesend, from Azores, had strong gales from NW. to SW. with heavy hail and rain squalls, and on 24th, 7 A.M., thunderbolt passed over the ship, emitting sparks, loud noise, and sulphurous smell, all the compasses more or less affected, and chief officer received a very heavy electric shock. 20th, "Evelyn," arrived at New York, was 18 days north of Cape Hatteras with heavy gales from NNE. to NNW. 21st, "Mary Leblane," arrived at New York, was 21 days north of Cape

Planetary Positions.

Hatteras, with heavy gales from NW. 10th and 11th, lat. 31° 28′ N., long. 78° 51′ W., heavy gale from NW. 13th and 14th, Ostend, gale from NNE. 14th, Kingussie, past week very stormy; thaw on 11th, and more snow with frost on 12th and 13th. 14th, Staithes, heavy fall of snow. 10th, Oporto, blowing heavily from NW., and a great deal of snow on high lands. 14th, Orlona, Croatia, violent shock of earthquake, destroying 200 houses. 14th, Dublin, 5 P.M., halo round the sun, followed by a violent storm next morning, with heavy fall of snow and rain. 14th to 18th, lat. 43° to 48° N., long. 25° to 13° W., heavy gales from NW. to NE.; bar. 28·60 for 4 days. 16th, "Seine" (s.s.), from St. Thomas, arrived at Southampton, last 2 days the bar. ranged from 30·65 to 28·75, with strong winds from S. and W. 15th to 20th, lat. 39° to 43° N., long. 36° to 22° W., heavy gales, and from 22nd to 24th, gales up to long. 13° W. 16th, Staithes, heavy fall of snow, with hurricane from SE. 17th, Baltic, very stormy weather. 17th, Braemar, hill and dale still buried in snow; the snowstorm has lasted six weeks. 17th, Lausanne, Switzerland, hail balls or lumps of snow the size of an egg, followed by heavy rain—much electricity in the air for some days. 19th, Keith, the snowstorm has now lasted five weeks. Portree, Skye, very stormy for some days, much snow and keen frost. 19th, Lisbon, gale from SW. to W.

Planetary Positions.

19th, Buenos Ayres, terrific storm from SW., doing great damage. 20th, North Sea, strong easterly gales have prevailed for the last five days. Cape Hatteras, 20th, violent gale from NW. to SW., and 27th to 30th, terrific gales with heavy squalls of hail from NW. 20th, Illinois and Indiana, terrible tornado, destroying everything in its progress, farms, houses, trees, wagons being swept away, and not less than 1000 persons injured (17 killed); a dense blackness enveloped the valley, whilst it was quite light on the hills around; most terrific roaring, rumbling, and moaning filled the air, and the smell of sulphur was very strong—travelled from W. to E., and the most violent and destructive natural phenomena on record. 21st to 23rd, Scotland, heavy fall of snow, with keen frost. 23rd, "Plantaganet," off Fastnet, experienced a hurricane from ESE. to NW., lasting ten hours, at its height, bar. 28·10. 23rd, Isle of Man, heavy gale from E. to SE. 25th, "Ashburton," from Liverpool to New York, experienced severe gale from SE. to NW. 26th, Keith, for 40 days there has been more or less snow. 26th, lat. 41° 34′ N., long. 60° 4′ W., heavy gale from NW. 16th to 22nd, lat. 52° N., long, 38° W., terrific weather. 30th, Halifax, N.S., heavy southerly gale. Auchterless, this month was one of the most tempestuous on record. 22nd to 25th, "Wm. Fotheringham," from Havre to New York, had very heavy gales from W. to SW. 10th

Planetary Positions.

to 29th, "Hope," from Cardiff to New York, experienced succession of westerly gales. 14th to 28th, "Harmonie," from Newcastle to New York, experienced succession of gales from N. and NW. 19th to 30th, "D. L. Sturges," from Gloucester to New York, experienced succession of gales. 24th, lat. 53° 50′ N., long. 2° 58′ E., hurricane from S. 24th to 28th, lat. 35° N., long. 59° W., heavy gales. 28th, Valparaiso, shock of an earthquake. 30th and 31st, Madagascar, violent storm. Cape of Good Hope, strong gales from SE. to NW. on 2nd, 3rd, 5th, 8th, and 14th, and at Klu Klu, on 7th, terrific storm with lightning, hail, and rain—hailstones as large as pullet's eggs. Melbourne, gales on 2nd, 3rd, 4th, 6th, 8th, 13th, 18th, and 26th. Auckland, N.Z., 31st, violent gale. Tasmania, 7th and 8th, strong gale. Madeira, 2nd April, weather lately very cold, with fall of snow.

April.

A month of gradually increasing temperature, with great reaction at the close; considerable oscillation of the barometer, and small amount of rainfall; the max. temp. in shade at London fell from 71° on 28th to 49° on 29th.

British Coast, gales an 1st and 2nd from NE.; 6th and 7th, from NE. to ESE,; 11th to 16th, from SE., SW. and W.; 19th and

Planetary Positions.

20th, from SE. to NW., 22nd to 25th, from NE. to ESE.; and 28th to 30th, from NE. 1st, Fomey, severe hailstorm, with violent thunder and fierce lightning. "Shandon," from Glasgow to Quebec, from 1st to 12th, gales from NNE., and on 24th, gale and heavy snowstorm. 7th, South of England, terrific thunderstorm with heavy rain and hail. 7th and 8th, Nexoe, Denmark, violent gale. 7th, Braemar, fall of snow. 8th, Paris, violent thunderstorm. 9th, lat. 11° S., long. 81° to 83° E., severe hurricane. 9th, lat. 34° 30′ N., long. 70° 3′ W., violent storm from S. to N., then SSE., and in one hour changed to NNE.; dreadful sea with torrents of rain. 9th to 30th, lat. 11° to 19° S., long. 49° to 87° E., severe hurricanes. 9th, "Atalanto," when 20 miles WNW. of Porto Rico, felt the shock of an earthquake which stopped the chronometer. 11th, "Mary Hamilton," off Valparaiso, experienced severe gale, and on the 25th a hurricane. 12th, "Ranee," from Akyab to London, was compelled to throw overboard part of her cargo from stress of weather. 8th, Cape Town, splendid meteor. 13th, Braemar, severe thunderstorm, with shower of hailstones, followed by a deluge of rain for two days. 10th, Bagdad, Mexico, heavy gale. 13th, Manilla, severe gale. 15th to 17th, Annan, unusual high tide with hurricane from SW.—tide as high as on 7th January, 1839. 15th, lat. 48° 32′ N., long. 29° 30′ W., heavy gale. 16th, Monte

Planetary Positions.

Video, gale; Nether Lochaber, wild shower of hail and sleet. 17th and 18th, Cape of Good Hope, severe gale. 17th, Aberdeen, ther. in sun 100°. 18th, Cattegat, vessel sunk during a heavy gale from NW. 18th to 20th, Baltic, very stormy from NW. 20th, North Russia, heavy gales from NW. 19th, Loch Lomond and Callander, fall of snow, hail on 20th, and frost on 21st. 21st, "Premier," from Trinidad, experienced terrific thunderstorm, lasting until 4 P.M. of 22d, when wind changed to W. and blew a gale for 12 hours. 17th, lat. 5° S., long. 80° E., a hurricane. 22nd and 23rd, Stornoway, heavy storm of wind and rain. 22d, Swinemunde, gale from ENE. 22nd, Inverness, temp. in shade 69°. 25th, St. Ives, gales for 2 days from ESE. 25th, lat. 44° 10′ N., long. 36° 30′ W., strong gale from NE. 25th, lat. 34° N., long. 73° 30′ W., heavy gales from SW. to NW. 26th, Paris, temp. in shade 75°. 27th, London, temp. in shade 80°; min. on 29th, 34°. Greenwich, temp. in shade 79°; min. on 29th, 38°. Dumfries, temp. in shade 75° 5′; min. on 29th (on grass) 25°. New Pitsligo, temp. in shade, 29° to 63° Kirkcudbright, temp. in shade, 69°, next day bitterly cold. 28th, lat. 47° 22′ N., long., 24° 32′ W., strong gale from NE. 23rd to 30th, Tunis, heavy gales from NW. to ESE. 28th, "Ocean Spray," in lat. 45° N., long. 19° 35′ W., in a sinking condition from heavy weather. 29th, Roxburghshire, min. temp. 21°. 30th, Cromar, min. temp.

Planetary Positions.

18°; Forfarshire, min. tem. 22°; Edinburgh, min. temp. 24°; East Linton, min. temp. 22°; Kelso, min. temp. 21°. 29th, Cape of Good Hope, hurricane from NW., with thunder, lightning, rain, and hail. 30th, near Rodrigues, a hurricane. 22nd to 3rd May, "Wagoula," from Tasmania to London, from lat. 45° to 49° 2′ N., long. 21° to 8° W., had easterly gales.

MAY.

1st ♆ 30° ☉
12th (x)
23rd ☿ 30° ☉
24th ♃ 120° ☉
26th (x)
29th ♄ 150° ☉
31st (x)

A fine month with gradually increasing temperature until 25th, when a sudden reaction took place, with decrease of barometric pressure—amount of rainfall very small. In Glasgow the range of temperature for the month was 33° to 72°, and, with the exception of the period from 7th to 11th, *the daily* range of temperature was considerable, varying from 13° to 29°.

British Coasts, gales on 1st and 2nd from NE., 11th to 13th, from WSW. to NE., 27th and 28th, from W., and on 30th and 31st, from E. 2nd, Glasgow, 7 P.M., suddenly dark and very calm, followed by heavy rain, wind S., at 5 P.M. it was N. 3rd, Birmingham, from 11·30 A.M. to 12·15, the town was enveloped in almost total darkness, and again at 4·30 P.M.; at both periods there was a moderate fall of rain, and little wind. 1st to 3rd, Inverness-shire, Kincardineshire, Dumfermline, Dunbar, and Dundalk, fall of snow, with frost. 5th, lat. 33° 3′ N. to 34° 2′ N.,

Planetary Positions.

long. 70° 42′ to 69° 2′ W., a hurricane. 11th, Perthshire, fall of snow. 12th, Calcutta, terrific storm, with thunder and lightning from NW. and E. 12th to 16th, "Clara Sayers," from Mauritius to Sydney, experienced severe gales. 15th, "Scotia," bound to Liverpool, was lost in a heavy gale off Amherst. 15th, lat. 34° S., long. 2° E., a hurricane and waterspout. 20th, "Duke of Sutherland," in lat. 56° S., long. 125° W., very heavy gale from N. to NNE. 22nd to 27th, "Seine" (str.), from St. Thomas, experienced strong easterly winds. 27th, Lerwick, 7 P.M., splendid rainbow reaching to the ground, and clouds overspread a large portion of the sky; at same time some high cliffs invisible from Lerwick, appeared depicted in the sky near the horizon, at length the cliffs became gradually indistinct, and finally disappeared, leaving the horizon clear as before. The bow was a perfect arch. 27th, Kingussie, very cold, with fresh fall of snow, and frost so severe as to blacken the potatoes, and on 29th, frost more severe than ever, with ice. 28th, Aberdeen, temp. in shade, 35° to 68°. 29th, Ayrshire, Stirlingshire, Aberdeenshire, and Kincardineshire, heavy hail shower. 28th, Quebec, gale with thick weather from E. 29th and 1st June, lat. 7° 30′ N., long. 96° 40′ E. Aberdeen range of temp. for the month, 29° 3′ to 68°. Islay, 30° to 71°. Skye, the driest season for 20 years.

Planetary Positions.

1st ♆ 60° ☉
9th & 10th (x)
16th ☿ ☌ ☉
19th & 20th (x)
22nd ♃ 150° ☉
24th ♀ 30° ☉
26th ♅ ☌ ☉
27th ♄ 120° ☉

JUNE.

This month was remarkable for its great range of temperature, small barometric range, little atmospheric disturbance, and small amount of rainfall. From the 10th to 19th the temperature fell gradually, producing frost and snow about the latter date, after which there was a rapid and extreme rise, followed by another reaction on 28th. A good deal of electric disturbance. Glasgow, range of temp. for the month. 35° to 82°; London, 41° to 89°. Coldest day on 19th, hottest on 26th.

British Coasts, gales from 1st to 3rd, NE. to E., and 15th to 18th, from SE. to NW. 1st, Kaffraria, Cape of Good Hope, slight shock of an earthquake, followed by a most brilliant meteor, which exploded with a loud report. 2nd to 4th, lat. 36° S., long. 26° E., violent hurricane. 3rd, Paris, gale with thunder and rain. 3rd, Cape Town, gale from N. 4th, lat. 49° S., long. 133° E., a hurricane. 5th, Doncaster, violent thunder-storm. 6th, "W. H. Jenkins," in lat. 47° N., long. 49° 40′ W., experienced very heavy weather. 5th and 6th, "Annie Longton," from Manilla to New York, experienced heavy gales from W. 7th, lat. 35° S., long. 27° E., heavy gale from N. to W. 8th, London, range of temp. 53° to 79°. 9th, Kew Observatory, range of temp. 49° to 80° 10th, France, heat very great. 10th, Cape of Good

Planetary Positions.

Hope, several meteors seen. 10th, Greenwich Observatory, temp. in shade 83° 8′, in sun, 145°. 16th, lat. 37° N., long. 14° W., heavy gale. 16th to 24th, lat. 28° 16′ to 39° 40′ S., long. 7° to 37° E., terrific gales, several vessels lost. 18th, Strathdon, hills covered with snow to some depth. Temp. fell 20° 5′ below the mean daily highest for same date for ten years past, and 12° below the mean average of the last 33 years for the 17th June. 17th to 21st, lat. 36° to 35° S., long. 18° to 19° E., violent gales. 18th to 24th, lat. 37° S., long. 36° E., heavy gales. 20th, Calais, Boulogne, Rotterdam, Kent, Folkestone, and Sussex, a remarkable meteor seen at 11 A.M. during bright sunshine, burst with tremendous report. 18th to 20th, Forfarshire, Stirlingshire, Kirkcudbrightshire, and Peeblesshire, sharp frost, causing much damage to potatoes and fruit. 11th, Captain Snellman, of ship "Freden," in lat. 29° 39′ N., long. 10° 21′ W., observed the whole sky as if on fire, lasting for a few moments, never witnessed such a phenomenon before. 17th to 10th July, "Sarah Nicholson" experienced violent gales off the Cape of Good Hope. 22nd, Lowestoft and Yarmouth, thunderstorm with heavy rain. 22nd, New Zealand, severe gale. 22nd to 27th, great heat throughout the country. London, 27th, 89° in shade, 165° in sun; Helensburgh, 24th, 124° in sun; Glasgow, 26th, 86° in shade; Dumfries, 25th, 87° 5′ in shade. 21st, Paris, temp. in shade,

Planetary Positions.

85°. 27th and 29th, London, terrific thunderstorm, with hail and torrents of rain. 27th, Newport, Windsor, and Bristol, destructive hailstorm, with thunder, lightning, and torrents of rain. 29th, Norwich, terrific thunderstorm, with torrents of rain. 25th and 26th, "Ethiopian," from Shanghae to London, sailed on 21st, experienced a hurricane, bar. 28·61. 24th, 27th, and 29th, Auckland, violent gales. 26th, Buffalo, U.S., terrific gale, with thunder, rain, and hail, doing much damage. 27th, Axbridge, terrific thunderstorm, with hail and torrents of rain; a ball of fire struck a house and shook it to its foundation. 28th, Kingston, Canada, last week heavy hail showers, followed by great heat and heavy thunder; storms on 26th, again followed by great heat. 29th, "Teresa," from Rangoon to Falmouth, experienced shock of an earthquake in lat. 31° N., long. 40° W. 30th, lat. 31° 57′ N., long. 38° 24′ W., severe shock of an earthquake. 28th to 1st July, Cape of Good Hope, gales from W. to NE. 28th to 4th July, lat. 35° S., long. 28° E., heavy gale. Great storms and floods visited St. Vincent and Demerara this month.

The *Leeds Mercury*, of 29th June, gives the following account of a phenomenon which was seen on 23rd in the neighbourhood of Cawood. A singular looking cloud, the shape of an elephant's trunk, gradually approaching the earth, when it seemed to burst and emit a great mist, after which there was an alarm-

Planetary Positions.

ing tornado tearing up everything before it, and when it crossed and re-crossed the river wharf it seemed to take up a large quantity of water to a considerable height. [This was evidently a waterspout, caused by the meeting of two opposite violent currents in the higher regions of the atmosphere, the temperature and vapour of water with which they were charged being very different, rapid condensation took place, and as the whirlwind increased, it descended. Their power to raise matter is enormous.—B.]

JULY.

1st (x)
4th ♆ 90° ☉
12th (x)
19th ♂ 60° ☉
4th ♃ ☌ ☉
24th & 25th (x)
29th ♄ 90° ☉
" ☿ ☌ 30° ☉

During this month great heat was experienced, resulting in some cases of sunstroke; also, severe thunderstorms, accompanied by heavy showers of hailstones. For the first three days the barometer remained low, and after that there was a gradual rise to the 11th, and for seventeen days in succession the mercury was above 30 inches—more than half the rainfall for the month, fell on 28th, 29th, and 30th. The range of temperature in the 24 hours was on some days excessive; in London on 13th it was 25°, and on 18th, 29°; and, as the month closed, the opposite was experienced, the range on 27th being only 7°. Cholera increased rapidly this month.

British Coasts, gales on 1st from SW., 7th to 9th, from SW., and 29th to 31st, with torrents of rain, from NE. to NW. 1st, Brae-

Planetary Positions.

mar, a meteor seen to SE., which burst with a loud report; heavens free of clouds. 1st to 4th, lat. 34° S., long. 28° E., heavy gale. 2nd, Dumfries and Airlie, terrific shower of hail. 3rd, Dundee, violent thunderstorm, with rain and hail. 3rd, Kirkmichael, intense heat, 3 cases of sunstroke. 4th, Greenock, shower of hailstones. 5th, Coatbridge and Bridge of Allan, thunderstorm, with rain and hail. 6th, London, heavy thunderstorm. 5th to 9th, Hong Kong, violent storms off the coast. 6th, 7th, and 9th, Typhoon in the China Seas. 7th, Lincolnshire, during the first week fearful storms have visited this locality, horses, cattle, and sheep being killed by lightning, and crops much damaged by hail. 9th, off Cadiz, a gale. 6th and 28th, Launceston, Tasmania, heavy gales, the 28th the coldest day during the winter; on 24th a brilliant meteor seen, travelling from E. to W. 10th to 13th, London, temp. in shade, 85° to 89°. 12th to 14th, Wimbledon, temp. in shade 84° to 90°. 12th, violent shock of an earthquake on the northern coast of Zealand, between Frederiksvark and Gillelein, about 30 miles from Copenhagen. 13th, South of Scotland, Perthshire, Burntisland, Leith, and English Border, terrific thunderstorm, with torrents of rain, and hailstones of an unusually large size; several horses, cattle, and sheep killed by lightning. 13th, Braemar, terrific thunderstorm, with little rain; heat excessive on 12th. 13th, Island of

Planetary Positions.

Lewis, terrific thunderstorm from SW. to NE., lightning very vivid. 11th to 14th, New South Wales, terrific gales from ESE., by which 16 vessels were wrecked and 100 lives lost; and on 29th, severe gale. 13th and 14th, Aberdeenshire, the thunderstorm on these days seemed to come from three quarters at once, S., SW. and N.; a large column of fire descended to the NE. of Braemar, making a serpentine zig-zag, and spreading out as it neared the earth in the form of a gigantic brush; in Glenclunie another flash formed a luminous arch like a rainbow, spanning from mountain to mountain. 14th, Caithness, most terrific thunderstorm, with torrents of rain; the lightning was startlingly brilliant, the flashes following each other in rapid succession. There appeared to be two storms, one in the east, the other in the west; the storm was preceded by a dense fog and slight thunderstorm the day previous. 14th, Fraserburgh, severe thunderstorm, the electric fluid entered the station and severed the telegraph wires. 14th, France, in central and southern districts, violent thunderstorms lately, with hailstones, doing much damage to the crops. 13th to 15th, Indianola, a hurricane. 19th, lat. 20° S., long. 51° E., heavy gale. 23rd, Dumfries, weather very hot for the last 14 days; max. temp. in shade 76° to 82° 5′. 24th, "John Patten," 200 miles NE. of Bermuda Island, struck by lightning in a tremendous storm. 27th, 30th, and 31st, lat.

Planetary Positions.	
	43° S., long. 76° to 81° E., heavy gales. 28th to 10th Aug., Australia, heavy gales. China, July and August, the heat of these months was excessive, the deaths from heat apoplexy exceeding that of several epidemics, Europeans and natives suffering alike.
	AUGUST.
2nd (x) 5th ♆ 120° ☉ 11th (x) 17th ♃ 150° ☉ 20th ☿ ☌ ☉ 25th & 26th (x) 31st ♅ 60° ☉ " ♄ 60° ☉	A mild month, with full average amount of rainfall—the daily range of temperature throughout being considerable, but no rapid extremes of cold and heat. The fourth week was marked for its high temperature; considerable amount of atmospheric and electric disturbance. While cholera decreased in London, fresh outbreaks took place in other parts of the country, and increased on the Continent. At Aberdeen, the spread of cholera was accompanied by a low mean temperature and excess of moisture. British coasts, gales on 3rd and 4th from SW. to NW.; 6th to 8th, from SW.; 11th, from SW.; 16th to 18th, from SW. to NW.; 26th, from S.; and 20th to 31st, SW. to NW., accompanied with heavy rain; the pressure on 4th at Liverpool was 26 lbs. to the square foot. 1st to 8th, Bombay, heavy gales. 3rd, "Ethiopian," from Shanghae to London, experienced a hurricane. 4th, Silloth, temp. in shade, 40° to 71°; in sun, 109°, and on grass 35°. 3rd, Rio Grande, heavy gale. 4th and 5th, Braemar, excessively cold and

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stormy from NE. with chilling showers of rain; snow on the Grampians. 6th, severe storm in Adriatic. 7th and 8th, hurricane in the Mediterranean. 6th to 8th, heavy gales in German Ocean. 9th, 10th, and 28th, South Northumberland, thunderstorm, with rain and hail. 12th to 15th, lat. 35° S., long. 18° to 24° E., heavy gales from NW. 16th, Banchory, terrific storm, with hailstones and rain. 19th, Argyleshire, torrents of rain. 14th to 25th, "Robert Leonard," from Quebec, experienced heavy gales from ENE. 11th, lat. 49° N., long. 46° W., heavy gale from SW. 18th, Cape of Good Hope, severe gale from NW. 21st, Shanghae, temp. in shade for the last fortnight has been 96° to 98°, and several deaths from sunstroke and heat apoplexy. 21st, lat. 38° to 29° S., long. 21° to 54° E., heavy gales. 23rd, lat. 22° N., long. 34° W., heavy gales from SW. 25th, Fowey, violent thunderstorm, with gale from SE. 8th, "Sea Nymph," from Singapore to Sydney, in lat. 27° S., long. 102° E., experienced heavy gale from W. 23rd to 28th, Cape of Good Hope, heavy gales, with rain from SE. 25th to 30th, "Evening Star," from Shields to Ascension, experienced strong gales from S. 27th, Staplehurst, severe thunderstorm, with heavy rain,—with torrents of rain on 29th. 27th, Boulogne, frightful thunderstorm, followed on 28th by terrific hurricane and a deluge of rain. 29th, Serious flood in Yorkshire. 30th, Dumfries, thun-

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	derstorm, with heavy rain. 30th, St. Petersburg, great heat continues to prevail, and cholera is spreading. 31st, Bathgate, severe thunderstorm, with rain and hail, 2 persons killed by lightning, and 3 severely injured. 31st, Constantinople and surrounding provinces, two slight shocks of earthquake. Callender, more rain fell this month than in any similar period for the last 14 years. 25th to 9th Sept., West India Islands, great heat, heavy rains and thunderstorm. Canada, 1st Sept., hardly a day without rain for the last three weeks, and yesterday culminated in a drenching rain storm.
	SEPTEMBER.
2nd & 3rd (x) 5th ♆ 150° ☉ 9th & 10th (x) 14th ♃ 120° ☉ 22nd & 23rd (x) 1st Oct. ♅ 90° ☉	This month was peculiar for its variable temperature; constant barometric oscillation, and large amount of rainfall. A month of storms, heavy rain, and much electricity. British Coasts, severe gales, with rain, hail, and thunder, 2nd to 8th, 10th to 21st, 25th and 26th from SW. to NW., and on 29th from NE. 2nd, Manchester, severe thunderstorm. 3rd, "Great Eastern," in lat. 51° 34′ N., long. 39° 33′ W., gale from NNW. 4th, Cape Town, heavy atmospheric wave, followed by thunderstorm and heavy rain, bar. 30·70. 4th, Stirlingshire and Perthshire, heavy rains. 4th, Lyttleton, N.Z., heavy gale from SW. 6th, lat. 40° S., long. E., a hurricane. Cape of Good Hope, strong gales

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from NW. to SE. on 3rd, 7th, 9th, 14th, 15th, and 20th. 6th and 8th, Midland Counties, heavy floods. 4th, Berkeley, Glocestershire, 1·67 inch of rain fell. 5th, lat. 14° N., long. 56° E., heavy gale. 7th, "Marian," from Antigua, experienced terrific hurricane 150 miles west of the Azores, from SSW. to N.; bar. fell from 29.70 to 28·25. 8th, Donarnenez, violent storm from SE. to NW. 8th and 9th, lat. 42° to 47° N., long. 21° to 31° W., hurricane from NW. 5th, San Francisco, violent shock of an earthquake. 8th, lat. 45° N., long. 29° W., a hurricane. 9th, Cape of Good Hope, terrific hailstorm, with thunder and torrents of rain, and on the 14th an unusual fall of snow. 9th, lat, 49° 34′ N., long. 14° 25′ W., heavy gale from WSW. 11th, "Heiress," from Cronstadt to Elsinore, experienced terrific hurricane from NNW., in lat. 54° 20′ N., long. 24° 17′ W., and on the 19th terrific gale. 10th, Earlston, severe thunderstorm, with large pieces of ice, some of which measured 1½ inches in length. 10th, lat. 49° N., long. 14° W., heavy gale from SW. to NW. 11th, Banff, Melrose, and Northumberland, heavy rains for the last 8 days, especially on 9th and 10th. 11th, North Sea, heavy gale from NE. 12th to 15th, lat. 38° 20′ S., long. Greenwich, strong gale from SE. 13th, P.M., Devonshire, two slight shocks of earthquake. 14th, France, severe shock of an earthquake. 14th, France, Switzerland, and North Italy, frequent rains,

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high winds and high temperature. 15th, Wigan and Stewarton, severe thunderstorm, with rain and hail; a girl struck dead by lightning. 15th, lat. 55° N., long. 1° E., heavy gale from WNW. 12th, Jamaica, terrific thunderstorm. 17th, Elsinore, heavy gale, from SW. 16th to 20th, lat. 11° 20′ to 18° 40′ N., long. 27° 30′ to 30° 10′ W., hurricanes from W. by N. to SE. 17th, "Evening Star," from Shields to Ascension, experienced a hurricane from NE. to SW., and on 18th heavy gale from W., in lat. 13° 20′ N., long. 28° W. 18th, lat. 15° N., long. 29° W., a hurricane from NE. 16th to 22nd, Greenock, 4·12 inches rain fell. 18th to 22nd, Johnstone, 4 inches of rain fell. 21st, Rothsay, violent thunderstorm, with rain and hailstones. 21st, thick coating of snow on the Grampians. 22nd, Newfoundland, terrific gale, with heavy rain from WSW. French frigate and several coasters lost at St. Pierre, where 150 dead bodies were picked up. 21st, Derbyshire and Yorkshire, lunar rainbow. 22nd, lat. 42° N., long. 62° W., very heavy gale. 22nd, Calcutta, severe gale, resulting in shipping disasters. 21st, lat. 36° N., long. 63° W., a hurricane. 23rd, lat. 46° N., long. 44° W., heavy gale from NW. 25th, Edinburgh and Inverness, lunar rainbow of great brilliancy. 17th to 24th, Nether Lochaber, a frightful week of gales, rain, and terrific thunderstorms, with hailshowers. 25th, the floods in France were more disastrous in their

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effects than those of 1846; the Nile overflowed its banks, and great inundations took place. 25th, lat. 51° N., long. 25° W., heavy gale. 23rd, Fortress Munroe, heavy gale. 23rd, lat. 10° N., long. 40° W., a hurricane from NW. 27th, lat. 19° 31′ N., long. 50° 1′ W., heavy gale. 22nd to 28th, Kelso, range of temp., 28° to 62°. 23rd to 29th, Perth, range of temp., 33° to 65°. 27th and 28th, severe gales off Cape Hatteras. 27th to 29th, vessels from Savannah to Richmond experienced severe gales. 20th to 29th and 30th, Porto Plata, St. Domingo, terrific hurricanes, many vessels driven ashore. 28th, lat. 23° S., long. 56° W., heavy gale. 28th and 29th, St. Thomas, Jamaica, terrific hurricane from NE. and S. 28th and 29th, China Seas, hurricane from NE. 28th, Edinburgh and Greenock, rain fell in torrents. 29th and 30th, Kirkcudbrightshire, Perthshire, and Stirlingshire, very heavy rains. 30th, lat. 22° N., long. 68° W., a hurricane. Port of Spain, for ten days at the close of the month the temp. in shade was 96°. Haddingtonshire, from 24th July to 1st October there were only 13 days on which no rain fell. 26th to 6th October, heavy gales from NE. to the north of Bermuda.

October.

1st ♅ 90° ☉
3rd ☿ ☌ ☉

The first ten days of this month were peculiar for their great humidity, fogs, and

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4th ♄ 30° ☉
5th ♆ ☌ ☉
8th ♂ 90° ☉
12th & 13th (x)
17th ♃ 90° ☉
24th & 25th (x)
1st Nov.
♅ 120° ☉

variable temperature, with high barometer, after which extremes of temperature and constant oscillation of the barometer occurred. There was a rise in the min. temp. on 2nd of 11°, and from 17th to 19th, of 16°; and a continuous fall from 20th to 26th of 24°, with a sudden rise on 27th of 16°. The rainfall was between the 18th and 29th. Some electrical phenomena. The gales of this month were very severe in the Atlantic and in east and west longitudes. Cholera severe on east coast of Scotland.

British coasts, strong gales—with heavy rain, 16th to 20th, from SE., 23rd, 24th, and 28th to 31st, SW. to NW. 1st to 6th, lat. 29° 30′ N., long. 79° 20′ W., terrific hurricanes from NW. to NE. 1st, lat. 24° 40′ to 42° N., long. 58° 36′ to 72° W., hurricane from SE. to NW. The effects of the hurricanes of 1st and 2nd at New Providence and Nassau were very disastrous, half of the latter town being laid in ruins, 92 vessels totally destroyed, 617 houses blown down, and 70 lives lost; one hour before the hurricane of 1st the bar. stood at 27·70, and the wind came away from NNE., and on the 2nd from the S. 2nd, lat. 20° N., long. 50° W., a hurricane. 1st, "Velocity," from Guantana to New York, in lat. 21° N., long. 73° W., experienced a hurricane and heavy gales from 16th to 18th. 2nd and 5th, lat. 50° and 51° N., long. 30° and 40° W., hurricane from SW. 3rd, lat. 35° N., long. 75° W., heavy

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gale from ENE. 2nd, lat. 48° N., long. 35° 30′ W., hurricane from SE. to NW. 3rd to 5th, lat. 33° 30′ N., long. 73° 20′ W., hurricane from ESE. to N. 4th, lat. 30° N., long. 72° W., a hurricane. 3rd and 4th, lat. 31° 54′ N., long. 64° 5′ W., a hurricane. 3rd, lat. 34° 35′ N., long. 74° W., hurricane from ENE. 2nd, lat. 50° 2′ N., long. 34° 11′ W., heavy gale from SE. 3rd, lat. 59° 30′ N., long. 29° 30′ W., heavy gale. 3rd, lat. 30° 14′ N., long. 79° 7′ W., terrific hurricane. 4th to 6th, "Moravian" (s.s.), from Quebec, experienced heavy gales. 5th, Nairn, aurora borealis. 5th, Chagford, Devon, shock of an earthquake. 2nd, 3rd, 5th, and 6th, Taganrog, heavy gales from SW. to NE. 5th, lat. 42° 38′ N., long. 43° 43′ W., strong gale. 5th, lat. 42° 30′ to 46° N., long. 45° to 51° W., hurricane from SE. to NW. 5th, lat. 43° N., long. 18° W., a hurricane. 5th, lat. 33° N., long. 60° W., a hurricane. 5th, Wick, brilliant meteor. 4th to 6th, Australia, heavy gales, with torrents of rain. 5th, lat. 45° 50′ S., long. 96° 40′ E., strong gales from WSW. 6th, Gulf of Florida, hurricane from NNE. All along the American coast the gales were very severe from 2nd to 8th, and 14th to 17th; also in the vicinity of the Bahamas the hurricanes from 2nd to 8th were destructive to shipping. 7th and 8th, "Emma," from Bremen to Philadelphia, experienced terrific hurricane from S. to N. 3rd and 13th, "Mediterranee," from Cape Haitier to Havre

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experienced violent gales from SSW. 7th, lat. 55° N., long. 51° W., a hurricane. 10th, New York, the str. "Evening Star," for New Orleans, foundered at sea with 258 souls on board, only 24 of whom were saved. 11th, Bayonne, thunder, lightning, and heavy rain. 11th, Washington, U.S., terrific storm, with deluge of rain. 11th and 12th, "Asia" (s.s.), from Liverpool to New York, experienced terrific gales. 11th to 14th, lat. 40° N., long. 66° W., hurricane from NNE. to ESE. 12th, lat. 47° N., long. 33° W., a hurricane. 11th to 15th, "Chatworth," from New York to Antwerp, severe gales. 13th to 20th, "New York" (s.s.), experienced heavy easterly gales. 14th to 17th, "City of New York," from New York to Liverpool, experienced strong gales from NE. 13th to 21st, "Redan," from Quebec to Penarth Roads, in lat. 47° 18′ N., long. 28° 13′ W., experienced tremendous gales from NE. to E. 14th to 16th, lat. 40° N., long. 68° W., hurricane from SSW., to ENE. 15th, lat. 27° N., long. 70° W., a hurricane. 14th to 18th, off Hatteras, hurricane from NNW. to NNE. 13th to 17th, lat. 39° N., long. 58° W., heavy gales from E. 13th and 14th, lat. 47° N., long. 43° W., violent gale from SW. to NE. 15th, lat. 34° 8′ N., long. 62° 13′ W., hurricane from SSW. to NNE. 14th and 15th, lat. 42° 47′ N., long. 40° 35′ W., violent gale from W. to NNW. 11th to 15th, China Seas, a series of hurricanes from NNE. to SSE. 13th and

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	19th, Manilla, severe gales from NNE. to SW. 15th, Dean Bridge, Edinburgh, beautiful meteor. 17th, Braemar, last few days very cold and stormy from NNE, the Grampians covered with snow since 13th, and the frost during last few nights very keen. 19th and 20th, "Scotia" (s.s.), experienced violent gales. 20th, Constantinople, weather very severe. 20th to 24th, Berdianski (S.W. Russia), strong gales with snow from NE. 17th, 18th, 20th to 22nd, China, series of hurricanes. 16th to 25th, Hobert Town, Tasmania, very stormy weather. 23rd, lat. 33° 9′ N., long. 41° 52′ W., heavy gale from SW. 23rd, Weymouth, lunar rainbow. 21st and 22nd, lat. 32° 47′ S., long. 134° 30′ E., terrific gales. 23rd to 25th, Brisbane, Queensland, severe gales and thunderstorm. 26th, lat. 30° 58′ N., long. 40° 8′ W., heavy gale from SE. 4th, 5th, 9th, to 11th, 19th, 23rd, and 24th, Adelaide, Australia, strong gales. 28th, Buenos Ayres, violent gale, several vessels wrecked. 29th, Boston, Portland and Wilmington, U.S., heavy gale from SE. 30th, lat. 51° N., long. 21° W., heavy gale from WSW. 31st, lat. 45° N., long. 40° W., heavy gale from SE. Cape of Good Hope and Australia, floods of rain this month.
	NOVEMBER.
1st ☿ 120° ☉ 3rd ♆ 150° ☉	This month was one of great variation in temperature, and constant oscillation of the

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7th ☽ ☌ ☉	barometer with some very heavy floods and much electricity,—the crowning feature of the month being the magnificent display of meteors on night of 13th and morning of 14th, which do not seem to have been visible in western longitudes.
13th & 14th (x)	
20th ♀ 30° ☉	
" ♃ 60° ☉	
22nd ♂ 120° ☉	British Coast, gales, with heavy rain,
25th & 26th (x)	hail, and snow from 5th to 11th, NW.
29th ♅ 150° ☉	to SE.; 13th to 14th, NW.; 16th, SE. to SW.; 18th, WSW. to NE.; 23rd to 25th, SW. to NW.; 27th, NW.; and 30th, SE. 3rd China Seas, terrific hurricane. 3rd to 5th, Port Saide, Egypt, severe gales from NNE. 4th, Beyrout, strong gale from NE. 4th to 6th, Buenos Ayres, terrific storm, with torrents of rain, several vessels wrecked. 4th to 23rd, China Seas, a series of heavy gales from NE. to S. 6th, Carthagena, Columbia, U.S., a large and brilliant meteor seen. 5th, San Francisco, heavy gale. 5th and 6th, Wick, terrific gales; force 66 to 67 miles an hour. 7th, Highlands, hurricane, with torrents of rain, snow, and sleet. Glasgow, 4th to 10th, range of temp. 27° to 55°. Paisley, 4th to 10th, range of temp. 28° to 57°. Perth, 4th to 10th, range of temp. 26° to 57°. Aberdeen, 4th to 10th, range of temp. 28 °to 55°. 9th, Hawick, brilliant band of electric light; and Edinburgh, a diamagnetic arch at a low altitude observed in the northern sky at right angles to the magnetic meridian. 11th, Kelso, a brilliant band of electric light. 8th to 10th, Pillau, Wustrow, Womermunde,

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and Gothenburg, terrific gales from SW. to NW. 10th, lat. 33° N., long. 12° W., gale from NNW. 11th, Orkney, hurricane, with violent thunderstorm. 12th to 16th, Launceston, Tasmania, heavy gales from S. 11th and 17th, Aberdeenshire, torrents of rain. 14th, Queensberry Hills, heavy fall of snow. 11th, Wick, thunderstorm and snowstorm on 18th and 19th. 15th, Dunbar, fall of snow, followed by a hurricane, with heavy rain from E. on 16th. 17th, Deal, "Faerie Queene," from Cronstadt arrived, reports in lat. 57° 42′ N., long. 5° 30′ E., a hurricane from NW. on 5th, and from that date, heavy gales from SW. to NNW. 14th to 18th, lat. 17° S., long. 77° E., very heavy gales. 16th, Skye, for some days nothing but storms and heavy rains. 18th, Lerwick and Thisted, hurricane with snow from NW. 13th and 14th, shower of meteors. Glasgow (St. George's Road), counted 722 in 45 minutes (from 12·25 to 12·45, and from 1 to 1·25 A.M.), time of max., 1 h. 10 min. A.M. London, Paddington Green, from 12 h. to 12 h. 36 min., 307 were counted. Highgate, from 12 h. 32 min. to 12 h. 36 min., 100 were counted, and from 12 h. 57 min. to 12 h. 59 min., 200 were counted. Bishop's Observatory (Mr. Hind), from midnight to 1 A.M. 1120 were noted; from 1 h. to 1 h. 7 min. 5 sec., 514 were counted; from 1 h. 52 min. to 2 h. 9 min., 300 were registered; from 3 h. 9 min. to 3 h. 24 min., 100; from 4 h. 42

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min to 5 h., 12; and from 5 h. 45 min. to 6 h., only 5 were counted. Several vivid flashes of lightning were remarked during the night. Greenwich, the number counted during the night was 8485. St. Andrews (Mr. Forbes), from midnight to 1 A.M., 883 were counted. Kent, 5600 were counted in 3 h., of which 160 streamed past in 8 min., from 2 to 10 min. past 1 A.M. Edinburgh, 8000 were counted. Malta, the meteors were seen to great perfection, some of them being very large, and, on bursting, left broad trains behind, which were visible for a few seconds. National Observatory, Washington (Prof. J. Ferguson), from 2 to 4 A.M., only 172 of small size were counted. Washington, 13th, from 10 P.M. last night to sunrise 400 meteors were counted, and these were the ordinary falling stars to be seen on any evening at this season of the year. Cape of Good Hope, from 1 h. 3 min. to 4 h. 21 min., 2742 were counted, the max. time being 2 h. 11 min. A.M. The appearance of these meteors caused a great sensation amongst the natives, some of them believing it to be one of the signs with which "the end of the world" would be heralded. 19th, 10·30 P.M., lat. 19° 30′ N., long. 74° W., 8 falling stars seen in quick succession. 20th, Nashville, Georgia, U.S., a brilliant meteor seen as large as the sun, which exploded with a loud noise. 16th to 20th, Aberdeenshire and Banffshire, severe snowstorm, with hurricane from N. on 18th, and severe gale on

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	19th. 15th, lat. 18° 53′ S., long. 73° 16′ E., hurricane. 18th and 19th, lat 30° S., long. 43° E., heavy gales. 21st, Pillau, heavy gale with hail and snow. 20th, Marseilles, severe from NW. 20th, Reval, gales with snow gale from S. for the past 8 days. 23rd, Banff, very brilliant lunar rainbow. 26th, Huna, frequent gales from N. to W. for the past 3 weeks. "Westfield," from Callao to London, arrived on 26th, experienced heavy gales from SSE. from Western Isles to Lizard., 24th, Oregon (lat. 42° N., long. 89° W.) severe shock of an earthquake, and at Yokahama (lat. 35° N., long. 133° E.), severe shock of an earthquake, and terrific hurricane, on 26th. 27th to 30th, lat. 53° N., long. 47° W., gale from NW., with hail, bar. 28·00 on 27th. 28th, New York, vessels arrived from Europe report heavy gales from 10th to 24th. 25th, lat. 38° N., long. 71° W., heavy gale from NW. 30th, lat. 4° N., long. 90° E., very heavy weather. Tasmania, remarkable high tides on 1st, and deluge of rain on 23rd; and heavy gales on 2nd, 6th, 22nd, and 25th. Kingston, Canada, range of temp. for the month, 14° (25th) to 53° (15), with great oscillation of the barometer.
	DECEMBER.
2nd ♆ 120° ☉ 5th (x) 7th ☿ ♂ ☉	A month of variable temperature, yet very mild, with a rapid fall as the year closed; great oscillation of the barometer; large

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9th (x) 11th ☿ ☌ ☉ " ♄ 60° ☉ 15th (x) 19th ♂ 150° ☉ 23rd (x) 27th ♃ 30° ☉ 28th ♅ ☍ ☉	amount of rainfall, and much electricity; a very stormy month throughout. On the 7th, the bar. reached its min. for the month, 28·67 at Glasgow, 28·46 at Halifax (Yorkshire), and 28·70 at Aberdeen; and this was followed by a rapid extreme reaction of 1 inch 62-hundredths in 35 hours. At the time of the explosion of fire-damp at Barnsley and North Staffordshire, the bar. from 13th to 15th only ranged from 29·09 to 29·27, having fallen from 30·29 on the 11th. British coasts, strong gales with heavy rain from 1st to 5th, from SE. to NW.; 6th to 11th, from SW. to NNE.; 15th, from WNW.; 17th to 19th, from SW. to ENE.; 22nd and 23rd, from SW.; and 25th to 31st, from SW. to NNE. 1st, lat. 13° S., long. 91° E., a hurricane. 3rd and 6th, lat. 36° S., long. 19° E., heavy gales. 3rd, Kirkwall, hurricane from SW. to NW. 3rd. lat. 59° 14′ N., long. 36° E., heavy gale from WSW. "City of Brussels," from Clyde to Calcutta, put back on 10th, having experienced terrific gales from SSW. to W., from 29th Nov. to 6th Dec., and hurricane on 7th from SW. to N. in lat. 51° 50′ N., long. 12° 30′ W., and severe weather on 8th and 9th. 5th and 6th, Cape of Good Hope, heavy gales. 7th, China Seas, terrific gales. 7th, lat. 22° S., long. 58° E., severe gale from ESE. 7th, lat. 37° N., long. 49° W., heavy gales. 7th, lat. 2° 28′ to 8° 45′ N., long. 106° 9′ to 107° 20′ E., terrific gales, with torrents of rain from NE.

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and SW. to NW. 5th, lat. 38° S., long. 24° E., very heavy weather. "Carmelita," from Tocopilla for Liverpool, experienced strong gales from 5th to 8th, with snow squalls, and in lat. 28° S., long. 28° 30′ W., very heavy gale from NNW. on 22nd. 8th and 9th, lat. 41° N., long. 48° W., very heavy gale. "Mariner," from Quebec for London, in lat. 47° N., long. 43° W., on 8th, bar. 28·20, terrific gale, with sleet, from ESE.—4 P.M., calm—6 P.M., thunder, lightning, and torrents of rain—9 P.M., terrific squalls from SW. 9th, 3 A.M., hurricane. 10th, heavy gale, with hail and squalls. 10th and 11th, Pomerania, Prussia, strong gales, with snow and hail, from NW. "Germania" (s.s.), from New York, arrived on 19th, experienced westerly gales the whole passage, and a hard gale on 15th from WSW. 11th, Reval, gale, with snow from NW. "Dunkeld," from Glasgow to Boston, put back to Greenock on 18th, experienced terrific weather from WNW., had proceeded as far as long. 15° W. 14th to 17th, "Belgian" (s.s.), from Portland, U.S., experienced very heavy gales. 13th, lat. 46° 30′ N., long. 45° 30′ W., hurricane, bar. 28·16. 13th, Cape of Good Hope, very heavy weather. 12th and 13th, China Seas, lat. 3° N., terrific hurricane. 16th, 150 miles SE. of Sandy Hook, hurricane from ESE. to WNW. 17th, lat. 36° N., long. 71° W, heavy gale. "Caledonia," from Clyde to New York, arrived on 19th, experienced

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heavy westerly gales, with snow, the entire passage. 17th to 19th, Cephalonia and Patras, hurricane from NE., several vessels wrecked. 17th to 19th, Tunis, heavy gales from NW. to NNE. 18th, California, terrific storm, with torrents of rain: railroads, waggon roads, bridges, and embankments, destroyed and carried away; cattle, horses, sheep, and swine, drowned by thousands. 18th, Brisbane, terrific hailstorm, doing much damage to property; very hot in forenoon, and sultry in afternoon. 18th, lat. 43° 7′ N., long. 54° 14′ W., heavy gale from NW. 18th and 19th, "River Dee," from New York to Liverpool, in lat. 41° N., long. 62° W., very heavy gales from NW. 17th and 18th, "Acadie," from St. John's, N.B., to Runcorn, experienced heavy gales from SSE. to SSW. 18th to 21st, Cape of Good Hope, strong gales from NW. to SE. 21st, Aberdeen, lunar rainbow. 18th to 22nd, Syra (Greece), very stormy, with hurricane on 23rd. 23rd, off Hatteras, heavy gale from SSE. 23rd to 26th, "Caradoe," from Demerara to Queenstown, heavy gales from SW. 22nd, "Admiral Fitzroy," from Algoa Bay, in lat. 3° 42′ S., long. 18° 14′ W., shock of an earthquake, ship as if going over ground, noise like distant thunder, weather very sultry and calm, bar. 29·90. 22nd, Halifax, U.S., severe gale from SE. 25th, Cape of Good Hope, excessive heat, 92° to 116° in shade; at Grahamstown, bar. 28·032 to 27·962, within

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2-10ths of what it was during the terrific gale in Table Bay in 1865. 25th, Edinburgh, Nairn, and Kelso, brilliant aurora and several luminous arches. "St. David's" (s.s.), from Portland, U.S., arrived on 27th, had heavy weather the whole passage, and very heavy gale on 26th. "Union," from Havannah for Falmouth, put into Scilly on 24th, having experienced terrific weather. 26th, Cattegat, gale from SSW. 26th to 28th, Bowmore, tremendous gales from W. 26th to 29th, "Lady Flora," from Gothenburg to Lowestoft, experienced heavy gales from NW. to SW. 26th to 28th, Chesapeke Bay, heavy gales from NW. 26th, Boston, gale, with snow from SE. 27th, New York, severe snow-storm. 27th, lat. 38° 50′ N., long. 72° 18′ W., heavy gale from WNW. 26th and 27th, lat. 37° N., long. 69° 50′ W., hurricane from S. to NW. 27th, lat. 35° N., long. 74° W., heavy gale from SW. to NW. 27th to 30th, Cape of Good Hope, heavy gales. 28th to 29th, Halifax, NS., severe gale. 27th and 28th, Huna, heavy gales from W. to NW. Highlands, 27th and 28th, very heavy rains; and 29th to 31st, heavy fall of snow, with frost. Ayrshire, 27th and 29th, very heavy rains; and 30th and 31st, snow and frost. West Lothian, 31st, heavy fall of snow, with frost. 29th, Staithes, perfect hurricane from NW. the whole of last night. "Research," from Quebec to Greenock, had nothing but gales from SW. to NW. the whole of Dec.,

Planetary Positions.	and on 28th was 150 miles from Tory Island, off Donegal, when an easterly gale sprung up which lasted for 32 days, the ship drifting to the SW., and did not reach Greenock until 5th February, having been 88 days on the voyage. B.

THE COLD PERIOD IN MAY,

AND

THE EXTREMES OF TEMPERATURE IN APRIL.

In "Good Words," for May, 1866, an article appeared, entitled, "Weather in May," calling attention to the cold period, occurring from the 13th to the 15th—an article very interesting to the public, but not so to the meteorologist, from the absence of anything practical in it. As the writer quotes Mr. C. Martin as an authority on this subject, it may not be uninstructive to inquire how far his theory is borne out by *facts*, as demonstrated in May, 1865 and 1866. Mr. Martin's theory is, that the temperature for the three days, 13th to 15th, are lower than *any other three* successive days in May. The following data are arrived at from *three daily* readings (in shade) of four thermometers, exposed to the four points of the compass:—

1865. Mean Temperatures—10th to 12th, 47·38°; 13th to 15th, 49·20°.—Min. Temperatures—1st to 3rd, 39·66°; 10th to 12th, 42°; 13th to 15th, 44·33°; 22nd to 24th, 39°; 29th to 31st, 39·66°.

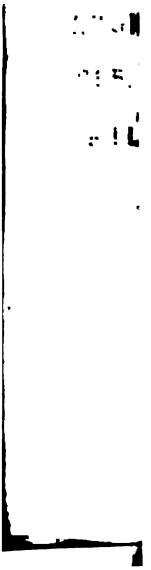
1866. Mean Temperatures—1st to 3rd, 41·60°; 13th to 15th, 47·83°.—Min. Temperatures—1st to 3rd, 33·66°; 4th to 6th, 34·33°; 7th to 9th, 38·66°; 13th to 15th, 38·66°; 28th to 30th, 34·66°.

These data speak for themselves, and sufficiently disprove the theory referred to. In same article, it was also

stated that bronchitis and pulmonary affections are the consequences of *this* sudden cold, as if the effects of such causes were *immediate* in their action. If the writer and such theorists, had directed their attention and labours to the *vicissitudes* of temperature (*means* are of no practical use) experienced in the month of April, they would verily have found ample food for their careful manipulation, as it is during *that* month, and not May, that the foundation causes of such complaints will be found to originate—which statement the reports received from the northern counties during the first 14 days of May, 1866, fully bore out. The extremes of temperature experienced the last few days of April (1866) were particularly remarkable as an illustration of the point—the following data are given :—

1866, London, April	27th,	Max. in	Shade,	80° ;	Min.	56°
	28th,	do.	do.	71° ;	,,	39°
	29th,	do.	do.	49° ;	,,	34°
Glasgow, ,,	27th,	do.	do.	69° ;	,,	38°
	29th,	do.	do.	52° ;	,,	30°
New Pitsligo,						
April,	27th,	do.	do.	63° ;	,,	29°

In Roxburghshire, there were 11° of frost on 29th; in Aberdeenshire, the thermometer fell rapidly on 28th, followed by a snowstorm ; and in one part of the country the thermometer fell as low as 18° on the 30th. To practically illustrate the cold and heat periods of April, I append diagrams for 1865, 1866, and 1867, showing the curves of temperature and pressure, with amount of rainfall, and the coincidence of these extremes with the orbital positions of the earth and planets ; which diagrams go far to prove the worthlessness of an "average" theory as a guide to our knowledge of what weather may be anticipated at *a particular period*, seeing such extremes never occur on the same date on any two years.



That such sudden and great extremes of temperature are the producers of disease, I cannot doubt: nay, more, I believe that to these phenomena, with the extremes of moisture, and electricity of the atmosphere, are to be traced the fountain causes of all epidemics, by their suddenly diminishing and increasing the secretions and excretions of the human body, thereby causing a loss of the balance of the proper functions of life. The following extract from the pamphlet of Dr. G. Bird on cholera, published in 1849, is applicable to this branch of the subject:—"The earth is a great chemical laboratory, and so is the atmosphere by which we are surrounded; so are the waters on, and under, and above the earth; and so are all animal and vegetable organizations. Heat, light, air, moisture, and electricity, perform some of the most important phenomena in nature; likewise displaying equally important phenomena in influencing and producing diseases. The *vicissitudes* of heat and cold will, *we know*, produce illnesses. It would be absurd to institute an argument merely to prove that different states of the atmosphere, and also its various acquired pollutions, influence the animal frame; it is familiar to us as a fact, and perfectly plain to the evidence of our senses, that the different degrees of moisture and dryness of the atmosphere, together with what in these states it contains, play important parts, there can be no doubt: we are all equally cognizant of this fact; so are we also that the quarter whence the winds blow influence health remarkably." B.

GLASGOW, *May*, 1867.

ADDENDA.

WHILE the foregoing pages were passing through the press, a friend sent us the prospectus of a new work ("Handy Book of Meteorology") by Mr. Buchan, the indefatigable Secretary to the Scottish Meteorological Society; and being desirous of extending our knowledge on this subject, procured a copy, which we perused with careful attention. Believing that Mr. Buchan has a larger amount of reliable data at his command, than any amateur meteorologist could possibly obtain, we naturally expected to find some *practical* conclusions as regards the *cause* of atmospheric changes; instead of which, we have the old and useless theory of "averages" unequivocally laid down, as "our only safe guides" to a fore-knowledge of the weather. In compliance with our expressed desire, that he would examine Mr. Buchan's work, for his opinion, Mr. F. Pratt sent us the appended communication. Coming from a gentleman who has for some years, made all the different systems of weather the subject of study, with the view of elucidating the true doctrine of weather changes and their causes, we deem the communication of sufficient importance to justify its addition to the present work. In addition to the practical testimony which he affords in favour of the astronomic system, from personal investigation and experience, it is the more valuable as coming from one, who, from his connection with the British Meteorological Society, cannot but have a full acquaintance with all the details of the system advocated by Mr. Buchan, and therefore thoroughly cognizant of what-

ever merits or defects, which may belong to the "average" philosophy.

Mr. Buchan is evidently a believer in the "circling" or rotatory motion of storms, but, unfortunately for all the advocates of this theory, two important points in all great storms remain *unexplained* by them—viz.: the *lull* or *calm right through the centre;* and *the line of minimum barometer*—which latter Mr. Buchan *finds fault* with Professor Espy for laying down in his charts. If Mr. Buchan desires to obtain *more light* on this subject, we specially recommend to his careful perusal, the letters by "R" on "Admiral Fitzroy and his System of Forecasts," where he will find the *true course* of storms practically laid down and illustrated.

The letter on "The Extremes of Temperature in April," &c., illustrated by diagrams, is with the object of showing the fallacy of the "average" theory, as applied to certain cold periods in that month; and as Mr. Buchan likewise *fixes* his day, or days of cold in April, and acknowledges he is "profoundly ignorant of the *causes* of such atmospheric changes," it is hoped he will lay aside his prejudice, and ask himself if there is *no* possibility of *another cause* existing for such, than what can be supplied by an "average" theory. As additional evidence of the vicissitudes of rainfall and wind force in April,—*facts* which no "average" theory could possibly lead us to foresee—we give the following data, taken from the Board of Trade Returns of 20 places:—

	Rainfall.		Wind Force.	
	Places.	Amount.	Places.	Force.
April, 1864.	125	40·34 inches	40	88·00
1865.	121	26·17 „	35	81·00
1866.	218	13·26 „	92	113·00
1867.	314	56·26 „	113	117·00

Almost every writer on meteorology brings forward the

statement of a periodic cold in May, naming *special* days when such low temperature may *annually* be looked for, forgetting to inform us, that, just as frequently, as cold, and sometimes colder periods occur, *before* and *after* the days named,* and ignoring the fact entirely that May is no more remarkable for this feature than any other of the inter-extreme season periods of the equinoxes. Let the months of September and October be put to the test, and we believe Mr. Buchan will find our statement fully verified. As no *two weeks* or *months* are ever *alike—changes* being the *law*—we have sought to illustrate this point in the appended diagrams of temperature, pressure, and rainfall, for December, January, February, and March, at same time showing the coincidence of the extremes with planetary position; and as Mr. Buchan makes a statement, on the authority of Professor J. D. Everett, "that saturation is an event as rare as eclipses of the sun or moon," we have included in these diagrams the days on which the hygrometer† marked the point of saturation. To Mr. Buchan, and all the advocates of an "average" theory, we commend the following pungent remark of Mr. Henry Rogers, in his "Letter on the Scientific

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* Minimum Temperature in May.

Glasgow—

1864, 1st 7th 8th 9th 10th 24th 28th 29th 30th
34° 35° 34° 34° 35° 36° 37° 36° 34°

1865, 1st 12th 16th 31st
34° 36° 37° 32°

1866, 1st 2nd 3rd 4th 13th 15th 16th 26th 28th 29th 30th
30° 31° 31° 33° 34° 34° 35° 37° 37° 37° 35°

1867, 13th 14th 15th 16th 17th 21st 22nd 23rd 24th 25th 26th
35° 33° 36° 37° 38° 37° 33° 32° 32° 35° 37°

Also, see "Havard's Climate of London for May, 1807-1830."

† Mason's Hygrometer, facing NW.

Apotheosis of Man":—"We never have *real* science till we have done with averages—science, strictly so called, knows nothing of them; we do not speak of mathematical propositions as being on an "average" true; nor of gravity as being on an "average" a uniformly accelerating force. *Averages* always imply as much ignorance as knowledge, and show that we have not science—for which, indeed, we substitute them." B.

MR. BUCHAN AND THE ASTRONOMIC AND AVERAGE THEORIES OF METEOROLOGY.

"THERE is every reason to hope, that no very distant period may put us in possession of the key to many of the most intricate meteorological phenomena, and enable us, though not to predict with certainty the state of the weather at any given time and place, yet, at least, to form something like a probable conjecture as to what will be the general course of the next ensuing season—perhaps to prepare us beforehand for violent and long-continued gales of wind, great drought, or extraordinary wet seasons, &c.; in the same manner that our knowledge of the nature and law of the tides, although confessedly imperfect, and in a great measure impirical, yet enable us to announce beforehand unusually high tides."—*Private Instructions by Sir J. Herschel*, 1855.

"In the matter of meteorology, there is a large and combined attempt to construct a science in Bacon's manner, which, as is now often acknowledged, never gave any success. . . . According to him (of the *Novum Organum*) when all the facts are collected, we shall construct meteorology as a person constructs a circle with a pair of compasses, with mathematical certainty, and no need of any sagacity. *But meteorology has not emerged as yet;* the *weather science seems as far off as ever*, with some few minor exceptions. The science that is to be, wants its Newton, and an attempt is made to provide him, by laying on an unlimited supply of Flamsteads. . . . In the present state of the subject,

any bit of theory, which, right or wrong, embodies a parcel of facts is WORTH VOLUMES OF WEATHER RECORDS!"—*Athenæum, October* 15, 1859.

My Dear Sir,—I am much obliged to you for the opportunity you have afforded me of examining and analysing Mr. Buchan's little book on meteorology. I have given it a very careful and patient perusal, and more especially that portion to which you directed my attention relating to the respective merits of the *astronomical* and the *average* theories of meteorology, on which Mr. Buchan so emphatically "pronounces." I need scarcely tell *you* that to both of these theories I have given a vast amount of labour and experiment during the last six years, in the course of an unwearying search for the correct philosophy of the *causes* of weather, and weather changes. I can only add that the perusal of this latest production of Mr. Buchan's, utterly fails to shake in the slightest degree, the opinions I have formed of the truth and practical value of the *astronomical philosophy* (par excellence) on the one hand, and of the utter fallacy and uselessness of the system of *averages* on the other. As relates to the two systems or theories, the issue is thus broadly stated by Mr. Buchan :—

Astronomical.	Average.
Page 188. "Any reference to Moore and other almanack makers is unnecessary, except as testimonies to a *wide-spread ignorance of even the most palpable elements of physical law, which is a disgrace to the educational system of this country.*"	Page 165. "But of the *causes* of these vast atmospheric changes, *we are profoundly ignorant.* The general prevalence of the polar and equatorial currents *may be, perhaps,* satisfactorily *reasoned about;* but why *on any particular day,* the polar current does descend from the frozen
. . . . .	
Page 189. "A strict ex-	

amination of the records of the weather in the Greenwich Observatory has proved conclusively, that *predictions based on the moon's changes are equally delusive.*"

Page 190. "All predictions based on solar *or other astronomical causes are useless.*"

regions and spread itself over Europe; and why at another time the equatorial current flows wholly or partially over that continent, the *area of our observation is too contracted to show.* Meteorology is eminently the *science of observation and averages.*" . . . Given, in *any locality*, an excess or diminution of atmospheric pressure, &c., *we know the atmospheric changes which will take place* in the effort to restore the equilibrium thus disturbed, and can to some extent turn this knowledge to account in predicting the weather; *but, as regards the specific conditions out of which these great atmospheric disturbances take their origin,* WE REALLY KNOW NOTHING."

Page 189. "The truth is, no prediction of the weather can be made at least in the British Islands, for more than three, or perhaps only two days beforehand; and any attempt at a longer prediction is only illusory."

Page 190. "But though no predictions of the weather, *weeks or months before-hand,* can

> be *made with any pretensions to trustworthiness*, yet *guesses* or *surmises* may be formed which are not without value. . . . . *Our only safe guides* are *averages, based on terrestrial observations.*"

Such is the unequivocal dictum of Mr. Buchan in relation to the two systems. In his condemnation of the one he is careful to enter upon no particulars whatever, his judgment is simply based upon "implication." In a few words he tells us of the "wide-spread ignorance of Almanack makers," and thence he travels at once into the higher regions of Greenwich Observatory to tell us of the moon's failings. Having thus embraced the two extremes of literature and science, he feels himself conpetent at once, and without further proof or argument, to proceed to the sun, and thence to pronounce judgment on the whole circle of astronomical causes, as disgraceful, delusive, and useless. Having thus settled the pretensions of "astronomy," he next proceeds to the "average" system, in which his judgment is equally singular and original. Candidly confessing the total absence of knowledge of any causes whatever—of any relation between cause and effect—of the utter want even of either science or philosophy, beyond "guesses" and "surmises," he declares meteorology to be "the science of observation and averages," and these latter, as based upon terrestrial observations, "THE ONLY SAFE GUIDES!" Of *Almanack makers* I have no wish to be the apologist. As to lunar influence, I need only allude to the elaborate paper and the accompanying tables of Mr. Glaisher (published in the proceedings of the Meteorological Society for March, 1867), "On the Influence of the Moon on the Direction of the Wind," to show that the question of such an influence is not yet settled even at

Greenwich Observatory. As respects the sun, the researches of such able observers as the names of Balfour, Stewart, and Warren de la Rue, show the influence of well-defined and active causes, and their indirect action upon our globe, as respects the weather. The only "other astronomical causes" are the planets. Between these and "averages," then, lies the question at issue. As defined by Mr. Buchan we have no details of science or philosophy to enter upon; no argument to disprove on either side. The question is simply one of utility, as a "guide" in the business and science of life. The question must therefore be judged by the evidence of *facts* and *experience*. Of the practical merits of the two systems, as well as of many of the principles laid down in Mr. Buchan's book, no better test can be had than that afforded by the experience of the Atlantic Telegraph Expedition. Being desirous of course of availing themselves of every possible means of success, the Directors of the Company and the expedition, made application to Lieutenant Maury, then Director of the United States Observatory, as to the best possible period for such purpose, so as to avoid, if possible, the occurrence of any storms prejudicial to its success. I need hardly tell you that for whatever merit the "average" theory may possess, it is entirely indebted to the able and patient investigations of this gentleman. Taking the observations of numberless vessels in all parts of the ocean for a series of years, he reduced these to means or averages of five days, in localities of a few square leagues over the greater portion of the navigable ocean. By this means, he added such a *general* knowledge of the average weather and currents to navigation, as enabled mariners, not only to avoid the more perilous localities, but to shorten voyages by many days. Under these circumstances, just confidence was felt, that in *particular* circumstances, the "average" system would prove an

equally *safe* "guide." Relying upon "averages," Lieut. Maury decided upon the month of June as one in which a storm in the Atlantic was impossible (as shown, of course, by the "averages"). On the 10th of June, 1858, therefore, the expedition left England, "as for a pleasure trip," with weather of the finest description. Scarce 48 hours at sea, and a change set in, culminating in a storm period of great violence for many days, in which one of the vessels narrowly escaped foundering, and the cable was finally lost.

The "average" system was thus fairly tested, under the most favourable conditions, and its failure as a "guide" unequivocally demonstrated. Why? Let me give the "astronomical" positions of the period, and the "test" of the comparative merits of the two systems:—

(Ms)	X	N	S	♅	(V)
8	12	15	19	23	26

On June 8, the earth passed its irregular angular position to Mars (a summer course of heat and substantial evaporation), to meet on the 12th, the reaction and break-up induced by Neptune and Saturn. On the 10th, the expedition, as a matter of course, started in the zenith of Mars' influence. "It was then to be a yachting cruise—a mere summer trip, and any talk of waterproofs would not have been more out of place in a drawing-room, than on the deck of the Agamemnon." 12th, The weather was dull and cold. 13th, Night, "gale seemed at its worst." 14th, Ushered in as "fierce a gale as ever swept the Atlantic," which continued till the 19th, when the fury of the storm became terrific. From this the storm gradually subsided to calm and beautiful weather on the 25th. Twelve days of the fiercest storm within experience, in the finest *average* period of the year, and in opposition to the judgment of the founder of the *average* system, ought surely to be taken as proof of

the utter uselessness of the *average* philosophy as *the only safe guide.* On the other hand, the coincidence of date, and the well-known reactionary tendencies of Mars' position, at once point to the existence of well-known and clearly defined *astronomical* causes, to their simultaneous action on the weather, and of the disaster and risk that might have been avoided by reliance on this latter philosophy as a guide. But these facts, while disproving the "average" philosophy, only show what the "astronomic" *might have done.* Let me, therefore, offer more direct evidence of the superiority and accuracy of the latter, as afforded in connection with the last and successful expedition. Here again, weather was the paramount consideration, and the first week of July, 1865—as a result, of course, of its "average" condition—was selected for its departure. Having investigated the former failure, and its weather causes, I naturally examined the contemplated period. This I found marked by the following singular positions, as denoted by a lineal diagram:—

(My) N	☌	♃	☉	☌	♅
1	7	14	16	20	24

Following *solar* positions of Jupiter and Herschel on the 15th and 21st of June, we have here on the 1st the violent stormy position of the earth's exposure to the combination of the sun and Mercury, further intensified by Neptune, followed by others of Jupiter and Saturn, as the causes of further action and reaction. Under Jupiter, on the 14th, came a probable upholding of stormy influences, intensified by the position of Saturn (16th) to further violence, probably enduring to the 20th. Feeling confident, from these two singular *astronomic* periods, that probable disaster again awaited the expedition, I could not forbear warning the authorities, spite of all the ridicule or contempt I might receive. On the 30th May, I wrote to Sir John Pender,

chairman of the "Committee of Construction;" explained to him by the diagrams the causes of the former disaster; pointed out the dangers of the first and third weeks of July, and the probable most favourable time that would follow the latter period. Now, Mr. Buchan writes that, "all predictions based upon solar *or other astronomic causes are useless*" —that *averages* were *worse than useless*, the former expedition had already proved. What were the facts in the latter? That in spite of the intention persisted in to the last of starting, the first day of July found the "Great Eastern" at the Nore, where she had to remain for a week, bending to the storm, the violence of which could not even allow the approach of vessels to finish coaling. At the Nore, she remained until the 15th, when she sailed, under remarkable circumstances, once more in disproof of the "system" of *guesses* and *surmises*, of *skyey and barometric indications*, which Mr. Buchan so ardently eulogises, for on that day the "Times'" correspondent thus wrote:—"All the *nautical authorities* on board are *confident* of *fine weather*, a confidence which is *certainly warranted*, not only by the *present aspect of the skies*, but also by the HIGH STATE OF THE BAROMETER!" Yet scarce 24 hours elapsed ere the ship was suddenly beset by the violent storms of the Saturn reaction, in one of which she fell in with the unfortunate "Caroline," having the shore end of the cable on board. In face of the warning of Saturn's influence, this vessel had been started from Falmouth, and but for the help of the "Great Eastern," would have foundered, with all on board.

Now, what can Mr. Buchan say to these facts? On the one hand, he says, "no predictions of the weather can be made weeks or months beforehand, — perhaps only two days," and that "our only safe guides are *averages*, based upon terrestrial observations." On the first occasion, attempts at a prediction, whether of months or days, proved

them to be alike useless and mischievous, and the science of "averages" a delusion and a snare. Equally fallacious also proved the "terrestrial observations" of the last expedition, as shown by the imminent danger and loss to which it was exposed in the case of the "Caroline," spite of the confidences of fine weather indicated to the "observation" of "all the nautical authorities." Can anything be more condemnatory of the fallacy and inconsistency of "averages," of "guesses," and "surmises," than these facts? In what remarkable contrast do "astronomical causes" stand? By this aid, six weeks warning was given of storm periods, which, despite the ridicule and contempt they encountered, were each fulfilled to the day, and the expedition finally brought to an uninterrupted and successful issue, in the period also indicated as the most fitted (astronomically) for the purpose. These are facts which Mr. Buchan ought to ponder over ere condemning astronomical causes as useless, and deploring "meteorology" as worse when applied to the investigation of cause and effect, the study of the past, or the experience of the future. There are, however, in Mr. Buchan's book, other periods and phenomena of a similar nature worth examination, such as the Black Sea Storm of November 25, 1855, and the Royal Charter Storm of October 24, 25, 1859, both instances of past Mars periods, similar to the "average" storm of the first telegraph expedition. That of the Black Sea was marked by the following positions—

	Mars.	Mer.	N	☿	(X)	J	
Oct.	29	3	8	12	14-15	17	Nov.

the storm falling precisely with the change of Jupiter's influence. In the case of the Royal Charter, the positions were—

	S N J Mars	(X)	☿
Oct.	16, 17, 18, 19	24-25	30

the reaction being developed by the transition to Herschel. As will be seen by the linear diagram, a powerful concentration of influences took place on the 16th to 18th, further sustained by the protracting position of the heat developing Mars, at the close of a very long period of heat and drought. Immediately, therefore, the earth reached the "transition point" of its orbit, the disturbing influences of Herschel at once broke up the long-sustained affinity of heat and vapour, the decomposition of which latter, and the setting free of its latent electricity, gave rise to a condensation of the volume of the atmosphere, of so sudden and vast a character, as to make that period not only a "landmark" in the history of meteorological science, but a starting point for a whole host of "terrestrial observations," not one of which has ever yielded, either a clue to its causes, or a single principle to serve as a caution for the future. In proof of the truth of this latter assertion, I need but refer to the period of September—October last, especially marked out for investigation by Mr. Buchan, at page 151, and further illustrated by two diagrams.* The period was, indeed, remarkable for its phenomena, and worth investigation. But here, again, Mr. Buchan realises the uselessness of his science, and equally fails to afford either clue to its causes, or any "average" guide for the future. In contrast, the "astronomical" philosophy again shows its analytical value, and

* In drawing his diagram of the Bahama hurricane in October, 1866, Mr. Buchan has set down the reading of the barometer 300 miles to the *eastward* of Nassau,—for which data we thank him—and the arrows to the *north* representing the winds as from N. to N.W., and those to the *south* as from S.W. and S.E. Now, why was there such a difference between the reading of the barometer at Nassau on 1st October, and that 300 miles to the eastward? For the simple and palpable reason that *from this quarter* the storm was proceeding, and, as Mr. Buchan knows, winds, like water down a hill, tend to the place of lowest pressure, it is a pure perversion of plain facts

the valuable lesson it affords for pre-observation and monition, by the following positions, shown by the "linear diagram" of the earth's orbit for that period :—

Oct.	♅	(My)	S	(N)	Mars	(X)	J
	1	3	4	5	8	12-13	17

Here, again, will be seen one of those remarkable concentrations peculiar to zodiacal motion, combined with the position of Mars, and the earth passing between Mercury, with the Sun on one hand, and the remote, but powerfully influencing planet, Neptune, on the other. And what are the coincidences? Turning to the North Atlantic and West Indian Coasts of America (localities peculiarly liable to such extremes about that season), we find, from the records, as well as from Mr. Buchan's book, the existence of minor disturbances approaching Herschel position—scarcely culminating with it—minor reaction sets in, in heavy storms, yet held in check by the forming solar position of Mercury, the power of which is shown by the fact that, scarcely have the *few hours* of this position time to wane, than the most extreme reaction sets in, with such a fury, as not only ravaged the whole North American coast, but, concentrating its force or centre over the island of New Providence, left Nassau in ruins, and wrecked every vessel in its harbours. Fortunately,

to maintain there was any "circling" or rotatory motion here. For some days previous to the 1st October, winds from the south had prevailed, which tended to depress the mercury; and at Nassau on the 1st., one hour *before* the hurricane, the barometer reached 27·70, when the wind came away from the N.E., and on the 2d October, from the S.W., a short calm intervening, and this was but the commencement of a series of hurricanes from E. (N.E.) to W. (S.W.), which raged from 30th September to 14th October, extending from lat. 20 deg. to 51 deg. N., long. 18 deg. to 79 deg. W., violent storms, also being experienced during the same period, in southern latitudes and eastern longitudes.—(*See* "*Atmospheric Phenomena for* 1866.")—Ed.

such extremes as these are of rare occurrence. But for this reason they only the more emphatically protest against the "average" system, as furnishing no induction whatever to avert such disastrous consequences. Yet the possible effects of these positions were pointed out in the "Shipping Gazette" prior to their occurrence, with the probability of the absence of any important reaction till the 17th, when Jupiter evoked the first "drum-warning" of the month from the Board of Trade.

Happily it is in our power to apply this philosophy to the future, and then any one may practically test the comparative merits of the astronomic and average systems.

September, 1867, is marked by the following positions:

☿	N	(X)	S	(My)	Mars	(X)	J	(V)
5	7	9-10	12	15	17	19-20	22	25

To the 17th we have the prevalence of two positions of great intensity of heat and evaporation—on the 22nd succeeds the stormy reaction of Jupiter, followed by the humid, pluvial influence of Venus, in conjunction with the sun, on the 25th. In many parts of the world, if not in Great Britain, this period will thus be worth both study and caution, from the tendency to a contrast of great extremes between the periods of the 15-17th and 26th. With possible extreme temperature, violent thunderstorms in Great Britain about the 15th or 17th, may bring a sudden reaction, productive of heavy rains and storms, having the centre of violence and extreme of barometric depression about the 22nd or 26th. The occurrence of Mars and Venus positions, whether separately or together, has always an important bearing upon the meteorology of a season. On the present occasion, this importance is greater, as affecting the character of a most important harvest month in the north of Great Britain. No positions of Mars (always so beneficent, from its evapo-

ration, to our harvests) characterised either the August or September of 1866. The last position of that planet was on July 19—the earth at same time passing between the sun and Jupiter. The great heat and evaporation of these concentrated positions gave rise to an extreme of reaction which, commencing with the double position of Herschel and Saturn on the 28th, prevailed till the middle of August.* Under the solar positions of Mercury, and the double position of Herschel and Saturn (then removed to August 29), partial evaporation set in to the close, when reaction again followed, endured through September, and inflicted irreparable damage on the harvest of the whole northern hemisphere.

Looking at these facts, only appreciable by the astronomic philosophy, we may have reason to congratulate ourselves on the contrast which the positions of 1867 offered for our harvest period, and more particularly for the north, as indicated by the position of Mars to September 17. This gratification is still more enhanced, on looking to the relative position of Venus. In 1863, September was then marked by two positions of this latter planet—on the 6th and 28th days. The consequence was an almost entire wreck of harvest prospects in Scotland, from the incessant rains which prevailed the whole month. In the ensuing September, while possibly ensuring from the favourable position of Mars, all the benefit of that planet for the welfare of our food supplies, we have unmistakeable warning that there

* The rainfall of 20 places in the Board of Trade returns of these periods, was—July 9-27 (19 days) 8·02 inches, at 63 places; July 28—Aug. 13 (17 days), 56·16 inches at 194 places! The ratio of reaction was thus as 7 to 1. Of this reaction, July 28-30 furnished 18½ inches, or more than double the fall of the previous 19 days! The same days of 1865 gave 1·40 inch! Where is the "average" philosophy of the two periods, 1865-66?

must be no procrastination, no trifling with favourable opportunities—that from the 16th we are in daily imminence of such a reaction as may extinguish all hopes of further favourable opportunities.

The occurrence of these relative positions of Mars and Venus in the harvest period of 1867 may not be without significance in other respects. From the occurrence of this Mars position, with others of equal intensity, in the close of July last year, there arose such an extreme of temperature as gave origin to a sudden and alarming prevalence of that occult disease, cholera, in England and many parts of Europe. Under the subsequent reaction, it, however, subsided, and gradually disappeared. But for this the visitation would have been very severe. The population of this country was, therefore, ransomed at the expense of its harvest. This year we have the first intensity probable in the similar period of June, in place of July, with the difference of reproduction of like influences for thermal intensity in August and September. The study of the period, in contrast with that of 1866, may therefore not be without interest in the history of this singular epidemic, which, seldom disappearing in one season, is this year more probable of recurrence, from the combination of the humid influence of Venus with the extreme temperature of Mars, and hence the production of that peculiar combination of heat and moisture, so paralysing to the vital functions. In this way the position of Venus, as productive of possible marked reaction following, or accompanied by much electric decomposition and lowering of temperature, may not be without its influence in checking the prevalence of epidemic disease.

But I must draw to a close. Of the *precision* of which meteorology is capable, the few instances I have adduced will amply demonstrate. I have not dealt with argument or "science," but with *facts*, in order to show fully the practical

relation of astronomic influences to the wants and purposes of human welfare, the operations of agriculture and commerce, and the preservation of humanity. I could well have gone to science and common sense, and shew, not alone the absurdity, but the utter want of foundation, in reason or nature, which characterises the system of "averages," a system which is but the mathematical reduction of "means" and "observations," which have no relation whatever to the phenomena of nature. Meteorology is not a *mathematical*, but a *physical* science, the study of extremes and intensities, the most irregular in their occurrence, duration, nature, and contrast. All that can be done by means and averages is to reduce these extremes and phenomena to one dead level of science. Thus obliterating every trace of collateral science of cause and effect, can we wonder at that "profound ignorance of the cause of atmospheric changes," that "widespread ignorance of even the most palpable elements of physical law," so lamentably deplored by Mr. Buchan? The "science" of meteorologists has failed, after years of observation, and the expenditure of thousands. Let them now give "astronomical causes" a trial. They will then learn from *facts*, not *fallacies*—will learn of "the most palpable elements of physical law" the sublime truth of Shakspeare, that "there are more things 'twixt heaven and earth than are dreamt of in *our* philosophy."—I am, my dear Sir, yours very truly,

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36	2 18 7	1 9 7	36	2 13 3	1 6 9
37	3 0 3	1 10 5	37	2 14 10	1 7 9
38	3 2 2	1 11 5	38	2 16 9	1 8 7
39	3 3 11	1 12 4	39	2 18 4	1 9 6
40	3 6 0	1 13 6	40	3 0 3	1 10 5
41	3 8 0	1 14 4	41	3 2 3	1 11 5
42	3 10 2	1 15 5	42	3 4 3	1 12 6
43	3 12 5	1 16 7	43	3 6 5	1 13 7
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45	3 17 7	1 19 0	45	3 11 4	1 16 0
46	4 0 5	2 0 9	46	3 14 0	1 17 4
47	4 3 5	2 2 3	47	3 16 10	1 18 10
48	4 6 8	2 3 10	48	3 19 11	2 0 4
49	4 10 0	2 5 7	49	4 3 2	2 2 0
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56	6 0 8	3 1 6	56	5 12 3	2 16 8
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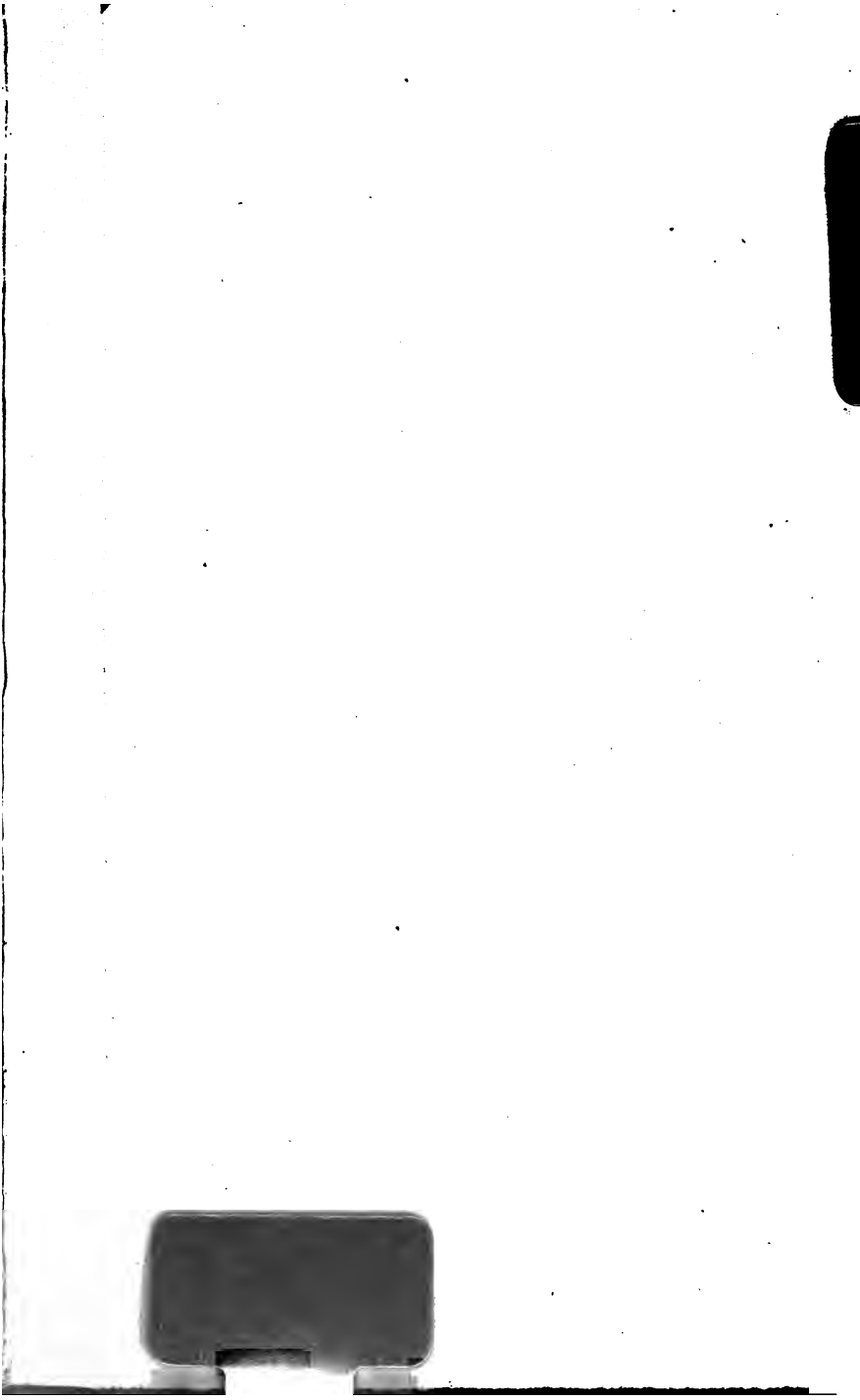
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